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THE

Psychological Review

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EDITED BY

J. McKEEN CATTELL
COLUMBIA UNIVERSITY

AND

J. MARK BALDWIN
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WITH THE CO-OPERATION OF

ALFRED BINET, ÉCOLE DES HAUTES-ÉTUDES, PARIS; JOHN DEWEY, UNIVERSITY OF CHICAGO; H. H. DONALDSON, UNIVERSITY OF CHICAGO; G. S. FULLERTON UNIVERSITY OF PENNSYLVANIA; WILLIAM JAMES, HARVARD UNIVERSITY; JOSEPH JASTROW, UNIVERSITY OF WISCONSIN; G. T. LADD, YALE UNIVERSITY; HUGO MÜNSTERBERG, HARVARD UNIVERSITY; M. ALLEN STARR, COLLEGE OF PHYSICIANS AND SURGEONS, NEW YORK; CARL STUMPF, UNIVERSITY, BERLIN; JAMES SULLY, UNIVERSITY COLLEGE, LONDON.

The Mental Development of a Child

By

Kathleen Carter Moore

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THE MACMILLAN COMPANY,
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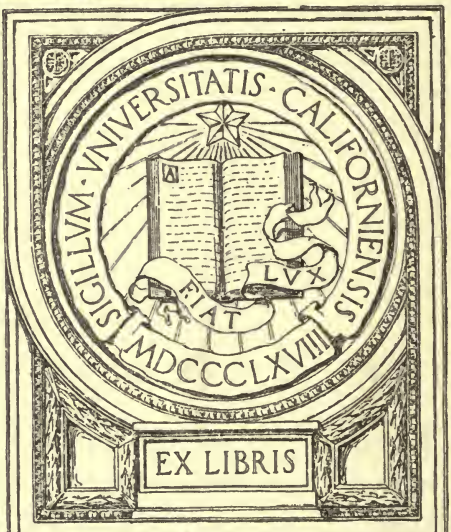

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PREFATORY NOTE.

It is unavoidable, yet to be regretted, that fuller bibliographical references do not accompany this work. In the presence of such a defect I must not omit an acknowledgment of indebtedness to Professor Preyer[1] and to Professor Wundt,[2] from whose works, more than from anything else which I have read, have been drawn the inspiration and enlightenment which enabled me to carry out my observations.

Mr. Moore has given me many suggestions and much help in the corroboration of observations—invaluable aids in the collection of facts.

[1] Die Seele des Kindes, translated and condensed by Miss Emma Marwedel, and appended to her book, Conscious Motherhood.

[2] Physiologische Psychologie.

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INTRODUCTION.

The attitude of mind in which an observer approaches the child must exert an important influence upon the interpretation of that which she observes. In imagination she may project herself into the infant's life, regarding him as a bit of humanity, potentially rich in thoughts and emotions whose manifestations are to be met with in any form of activity whatsoever. The unfolding germs of mental life, she may be inclined to identify as the seed leaves of a glorious plant. Such an attitude is not conducive to an impartial interpretation of facts. To read too much between the lines may obscure the true meaning of the text. On the other hand, an observer may watch the child with intelligent interest to learn what she can of the processes of development. She weighs, sifts and classifies; she regards the child as a child, and not as a diminutive man. It is obvious that a well proportioned mixture of two such positions would give a basis upon which to accomplish most. She who is so profoundly imbued with the love of her subject that nothing is too trivial to evoke a sympathetic response, yet in whom the habit of reflection is so strong that no observation can be allowed to pass unmeasured and unclassified, will be the one to gather the greatest harvest of facts, to estimate justly the value of each, and its relation to all.

A condition of equal moment to that of the observer is that of the observed—the subject. Everything must be subservient to the comfort and welfare of the child. Over-excitement and fatigue are injurious to the child; and, as much intercourse with people produces both excitement and fatigue, observations must sometimes be brought to a standstill when one feels oneself on the verge of important disclosures. Nor can the young child always be made to act under a given set of conditions. The chances are that he may not respond to one's cleverly arranged experiment.

Personally I have constantly been impressed by the extreme difficulty of making tests. Most of my attempts to obtain results through experiments have proved signal failures.[1] I early gave up the idea of obtaining the bulk of facts with the help of experiments, and occupied myself with the observation of the phenomena of development, as they one by one arose and assumed more generous proportions and complicated relations. Nor did I find any dearth of material. I can say now, with a vast quantity of classified facts at hand, that the method which I employed holds its own with any other. Every verified observation made under known and carefully noted conditions, is as valuable as an observation made under prearranged conditions. But the facts are more unwieldy to handle, and it requires endless patience to get them.

In brief, my method comprised:

I. { *A*.—The observation of all manifestations of activity.
B.—The observation of the conditions under which a given manifestation occurred.
C.—The prompt recording of *A* and *B*.

II. { *D*.—The observation of all manifestations of change.
E.—The observation of the conditions under which a given manifestation of change occurred.
F.—The prompt recording of *D* and *E*.

The facts obtained from I. gave data from which to study the formation of habits, the fixed lines of activity. Those obtained from II. afforded a basis for a study of expansion and development. Beside this, summaries were written out at stated intervals which described and reviewed the mental condition of the child at given periods. The first of such descriptions summarized the advancement in all lines of activity. Later, when there was so much to record, it was found more satisfactory to confine a summary within the limits of a definite set of activities.[2] Tendencies also were carefully noted.

[1] I do not wish to be understood to oppose the employment of the experimental method. Doubtless my own want of ingenuity in devising experiments had much to do with my lack of success.

[2] Language, association, etc.

No observation has been incorporated into the body of facts out of which this story of development is woven, which has not received corroboration from subsequent observations. Excepting those of the first seven days, in which I was greatly assisted by my husband, and twelve sentences recorded in the second year, all observations herein presented were made and recorded by myself. In one respect, my observations sometimes lacked completeness. As this has been the only infant mind whose unfolding I have carefully followed, I failed to recognize in all cases the first appearance of each advancing step; hence, my time record, though always approximately accurate, is sometimes at fault by a few days, or even a week; I have therefore adopted the custom of recording dates by weeks instead of by days, after the sixtieth day. Fortunately in such cases, in pursuance of the plan summed up in II., there existed in the journal a register of the gradations by which the higher plane had been reached.

Notes of the reactions of the child to the normal surroundings are the material most of value in such a study as the present one. But such material does not easily lend itself to the manufacture of quantitative tables. In writing out my results, I have, where tabulation was difficult, arranged series of typical observations in a progressive form. These have the advantage of placing before the reader facts from which, if he so choose, he may independently draw his own conclusions. They have a further advantage. I have ventured to hope that some mother wishing to understand her growing child, and eager to be in close sympathy with the pulsations of baby life, might seek assistance in these pages, and I knew that the record of concrete cases would be of help to her.

The course of my child's development has, I believe, been a normal one. He suffered but little from interference, and was never stimulated to premature action. He was accustomed to playing alone. Especial care was taken not to teach him the tricks which are commonly taught to babies; but some he did learn. He heard neither 'baby talk' nor any of the set phrases which are regarded as suitable to the comprehension of small children. When it was necessary that he should be taught habits essential to his welfare, no pains were spared. Regular

hours of feeding, sleeping, etc., were maintained. Good health and rapid growth have uniformly been his.

The period of infancy is said to extend over the first two years of life. In order to give an introductory outline of the movement and direction of development, I have subdivided infancy into four periods, each of which is characterized by the vigorous growth of some form of activity. These are no artificial divisions made for purposes of convenience. The close of one period overlapped the beginning of its successor, but the respective high-water marks were clearly distinguishable.

The development, practice, and use of the sensory apparatus belonged primarily to the first year, while the formation of concepts and the acquirement of language were characteristic of the second year, as speech and action daily served to show. The four periods have been designated accordingly as those

1. Of seeing.
2. Of feeling.
3. Of examination.
4. Of speaking.

Three of the four periods were completed within the first year; the fourth extended over the entire second year. The first was of four months' duration, beginning at birth. Sight cannot be said to have been more active during this time than later, but it was certainly more active in proportion to the activity of the other senses than at any subsequent period. The child was entertained almost exclusively by what he saw. At the close of the fourth month, he had learned to distinguish some sounds and to localize them to a certain extent. Muscle and skin sensation had also developed considerably during the four months, and he had acquired some control over his own body. Concerning taste and smell, I found little to record. The point which I wish to make in thus referring to the degrees of development which other senses had respectively attained is, that of all senses sight was the one whose objects engendered interest, engaged attention, stimulated effort and furnished material for a later growth of ideas. I have called this period that of seeing, wishing to make a distinction between seeing and active looking, which latter term is too closely related to

examination to express the mental attitude of the child during the four months in question.

At three months of age, the child for the first time was observed to follow with his eyes his own reaching and grasping hand. From this time, the ability to reach for and grasp objects developed rapidly. By the end of the fourth month he took pleasure in feeling of all sorts of things which came within his reach, from his clothing and parts of his own body to the balls of the first Froebelian gift. Gradually the desire to have and to finger things developed, until the pleasures of sight alone were no longer sufficient, but had to be supplemented by the satisfactions of touch. The second period has been called that of feeling. At first glance, the term may seem too general; but there is no other which fits so well. Either contact or touch would be too specific; for I wish to include in the term, sensations from the whole series of activities involving the use of muscles, bones and skin. All general bodily activity gave him pleasure so long as it fell short of fatigue. The ability to recognize and localize sounds increased in a marked degree. But feeling was undoubtedly the source from which the child derived most during his second period. When sitting became a habit, feeling gave place to examination.

The foundations of the more developed activities of the third period were laid by the continual looking and feeling of the first seven months. During the five months covered by the third period the child was developing along all lines. He was chiefly engaged in acquiring control of his own body, and in the examination of common objects. He gained considerable knowledge of familiar household objects through handling them, placing them in all sorts of positions, putting together and taking apart. He learned to sit alone, to raise himself to a sitting position, to pull himself upon his feet, to stand and to step forward with assistance in balancing, to roll, to get on his hands and knees, to creep, to feed himself from the bottle, and with bread also. He learned to use a few words and to understand a number. He showed himself capable of forming some abstractions. And the primary links were formed of that chain which, in later life, binds each of us in some measure to his social inheritance.

The acquirement of language was the conspicuous feature of the fourth period. At its beginning—at the close of the first year—the child had a vocabulary of but few words, though a language of gesture aided him in making known his wants; at its close he commanded enough of language to place him in intelligent communication with other persons. He learned during the fourth period to walk alone, to get upon his feet without pulling himself up by the arms, to run, to walk on knees, toes or heels, to go up and down the stairs or an inclined plane, to climb on the furniture and to take care of himself in all ordinary situations. He performed a number of acts requiring nice muscular adjustments. The range of perception became extended with astonishing rapidity. New ideas were formed and old ones modified. In short, change and progress occurred everywhere during the second year.

There are some other features of development which should be considered in such a general review as this. Progress, uninterrupted as its course was, still had seasons of noticeable acceleration and intervals of extraordinary slowness. I was unable to discover what causes governed the varying rate of advancement. A known physical cause acted as a retarding agent only once; namely, when a bad cold made it prudent to keep the child from the floor just as he was learning to walk. He suffered no real set-back then, merely a postponement of accomplishment.

The first of the seasons of rapid development began on the thirty-fifth day. It was ushered in by a day of awakening,[1] upon which the child seemed extraordinarily bright and intelligent. His face wore an expression of alertness and he evinced a new interest in objects. He looked continually at persons, smiled repeatedly at them, and responded to words addressed to him by various cooings and gurglings. When the child was three and a-half months old, another peculiarly bright day occurred. Upon this day also he seemed unusually alert. He appeared to understand what was being done for him, and fell naturally into the scheme of regularity which I had tried to maintain. From that day he composed himself for sleep when, at the hour for his nap, he was laid upon his bed.

[1] Preyer describes such a day.

The third period of rapid development occurred in the eleventh month. The ability to creep, acquired within a few days, ushered in another means of gaining perceptions, so that within two weeks the child seemed to have learned a great deal that was new.

The fourth period came with learning to walk (fourteenth month). During it, he gained much in the art of using his body to advantage, and acquired a new understanding of certain features of his surroundings which previously he could take in by sight only. Some words were added to his vocabulary.

An interval of six weeks separated the fourth and fifth seasons (sixteenth month). During the fifth period, which lasted for two weeks, the rate of development was a rapid one. The sixth and last season was observed in the twenty-first month, when words, hitherto added to the vocabulary so slowly, came into use at the rate of one to three daily.

It was difficult to estimate the length of one of these seasons, which seemed to wax suddenly, and to wane gradually. The gains made while they lasted, remained with the child to be incorporated into his daily life; no premonitory signs announced their approach, though he was slowly preparing for each during the interval which preceded it. In looking for an explanation of the periods these facts would seem to point away from a field of causation wholly external to the child. Perhaps like a clay modeller who works by turns upon each portion of the figure he is moulding, and finds his model finished as if by magic beneath his touch, the child, experimenting now here, now there, gaining control first in one direction then in another, one day surprises his elders by a display of knowledge and ability of which they had not supposed him possessed. The acquisition of new power then leads to an increase of knowledge and the growth of further ability along related lines. However this may be, the rate of progress apparently became more uniform after the sixth period, because the striking features of its course had been developed.

PART I.—MOVEMENTS.

PRELIMINARY.

All motor manifestations of the child, from the spontaneous physiological activities of nerve centers and muscles to the complex actions of later infancy, may be classified as movements. Hence, this has been selected as the most suitable term under which to subordinate the several divisions contained in Part I. of the present work. The materials for the study of the development of movements I have classified under eight heads, as follows:

1. Spontaneous
2. Instinctive
3. Habitual
4. Voluntary
5. Automatic
6. Inhibitory
7. Expressive
8. Mechanical

} Movements.

The succession in which this enumeration of the classes of movements is arranged does not indicate, except in the roughest way, the order of their development.

According to the classification made by Preyer, which has been quoted and used by other authors,[1] the movements of a child have been arranged in four groups,[2] designated—

1. Impulsive
2. Instinctive
3. Reflex
4. Voluntary

} Movements.

At birth, movements of the first class (spontaneous or impulsive) were the most conspicuous. Immediately after birth, the

[1] For example: *The Psychology of Childhood*, Tracy, 2nd edition, p. 92.

[2] *The Senses and the Will* (Preyer), pp. 195–201. Also *The Infant Mind* (Preyer), pp. 51–55.

child continued to lie in a position which closely resembled that of the fœtus. The early movements were generally conditioned in range and direction, by the maintenance of this position. Within an hour after birth the arms were waved towards the head and face; the legs were repeatedly straightened and flexed, the eye balls rolled continually beneath the closed lids, the muscles of the face were active. With the development of action, movements such as these gradually disappeared. The change was very noticeable in the case of the eye ball. With increased frequency and perfection in the visual coördinations of the eye muscles, the eyeballs ceased altogether to roll about (during the hours of wakefulness.) Preyer, observing (a) the number and variety of the early movements, (b) the occurrence of adaptive movements while the spontaneous movements were conspicuous, and (c) the gradual disappearance of the early movements as adaptations became habitual, was led to regard adaptive motor coördinations as combinations of the purposeless movements, fortunate in their results, and therefore selected and preserved. He then ascribed to them the function of progenitors to the succeeding generations of movements, whether these be habitual bodily activities (walking etc.), or voluntary actions. To movements standing in this ancestral relation the name impulsive might fitly be applied. But a consideration of the phenomena of movement, and in particular the observation of just what movements were selected for further development, have led me to the belief that the significance of these movements is not what Preyer supposed it to be, and that they are in consequence more correctly named spontaneous[1] movements. In this series of independent, but related studies, spontaneous movements are not treated in a separate division. They are often referred to and severally described from time to time during the course of the discussions.

The definition of instinct here adopted as a basis for the discrimination of certain classes of movements is this: An instinct is the ability to perform without previous individual experience, a given purposive act by which changes in con-

[1] As such they are designated by Bain, *The Emotions and the Will;* The Will, Chap. I., and by Prof. Baldwin, *Mental Development*, p. 81.

scious states are induced. This definition does not permit of the inclusion in the class of instincts of the habitual actions called race instincts. One and all of the race instincts (sitting, walking, running, etc.), were acquired slowly, and their attainment was the result of a great number of previous trials, failures and partial successes. Herein they differed widely from actions which were at once performed without experience, such as sucking and clasping. In order to show by comparison that the manner of acquiring a habit common to the human race is in no wise different from the way in which a personal habit becomes fixed, I shall describe fully the rise of one habit of each class—grasping, and sucking the thumb.

The studies of these have moreover a three-fold purpose:

I. To give the history of the rise of the habit.

II. To ascertain the primitive, or simplest types of movement upon which were built up subsequent coördinations, complications, and modifications of movements.

III. To discover the principles upon which rested the development of the series from the types.

The movements described as habitual, voluntary, automatic and inhibitory are closely related forms of activity. In the chapters devoted to the discussion of these movements it will be more clearly shown what, and how close, the relationship is.

All my notes on movements might be called into requisition for a study of the development of automatism in the child. There is no doubt that the child at birth was a being less endowed than at two years of age with the ability to perform automatic acts, and possessed with fewer forms of the same. Without, however, pretending to cover the general question, I shall give the history of some automatic actions.

I could not in this study in individual psychology, discuss adequately the standpoint of modern psychologists on the question of emotional expression and development. The evidence obtained from a single individual may be sufficient to make one distrust general conclusions, and yet in itself lack the volume and detail upon which to base new ones. In the chapters on movements of expression and mechanical reflexes I have recorded facts which related to the development of the child, but

the material, though suggestive, was somewhat too scanty to be used as the foundation of special studies within the respective fields.

Before bringing these preliminary remarks to a close it may be well to record examples of the survival and transformation of some spontaneous movements which were preserved in connection with forms of habitual actions. These, because of their relation to the subject of reaction time, belong to movements as a whole rather than to any one class. The spontaneous movements were quicker and often more jerky than voluntary movements. Thus many movements made within the first two months had an appearance of rapidity which was in curious contrast to the slow and trembling motions with which he made his first attempts at reaching and grasping. If the reaction time of the child were judged by sensori-motor standards (for example the hurt and the cry, the noise and the movement), the time of reaction always seemed long. Some rapid movements were preserved in grasping, however, as reference to the examples under that heading will serve to show. First, he grasped what came within the range of his sweeping arm. Then, he sometimes gained a sighted object by a rapid arm movement, a reproduction of the sweeping one, which was more likely to succeed than was reaching by his newly acquired method. When a strong desire to take everything in the hands had grown up, the child developed such quickness at seizing, with the same arm movement, what he passed or was near, that he often took an article from beneath one's eyes ere one realized that he had stirred. When he could sit upon the floor and had learned not to plunge forward so that he fell, rapidity of action was extended from arm to body movements, enabling him by a sudden lurch and recovery to regain what had rolled away, or to catch what approached him. At the close of the second year the rate of movement was generally more uniform; it was not varied by phenomenal slowness at the one extreme, nor by startling quickness at the other.

SECTION I.—HABITS.

A Personal Habit: Record.

First Day.—Within an hour after birth the child was seen to be sucking his thumb.

Fourth Day.—Sucking the thumb again occurred. Between the first and fourth days he often sucked his fists. During the first month he was not prevented from doing this, but his thumb was always taken out of his mouth.

Twenty-second Day.—He had not formed the habit of sucking his thumb, but, in the turning and twisting of the fists, the thumb sometimes found its way into the mouth.

Thirty-fifth Day.—In this manner he twice got the thumb in his mouth.

Forty-ninth Day.—By this day he often got the thumb into his mouth. If it was taken away from him, he sometimes, after an interval not exceeding twenty minutes, got it again. After a long interval he did not take his thumb, but sucked his fists. These would seem to have suggested the thumb, which by turning his hands, he soon obtained.

Tenth Week.—Holding the four fingers closed, the thumb extended, the child raised the thumb towards his face, no longer beginning with his fists. He was quite as likely to strike his forehead, eyes or cheek with his thumb as to place it in his mouth. Spontaneous arm movements interfered to prevent his holding the thumb in his mouth, and caused the hand to be jerked away. If this happened many times the child cried from vexation. In the excitement of crying the arm movements increased, and the less certain became his hold on the thumb. In spite of these obstacles the child usually persevered till he succeeded in getting the thumb firmly in his mouth.

In the tenth week he was vaccinated, and the doctor advised that the child, who was slightly feverish, be not worried by attempts to prevent his sucking the thumb. Doubtless thirst and feelings of general discomfort caused the child to suck more than usual. At any rate the habit became fixed in the two weeks during which the vaccination took its course.

Eleventh Week.—He no longer experienced difficulty in holding the thumb in the mouth. If his mother's breast was offered to the child while he was sucking his thumb, he made no attempt to take it, but sucked on contentedly, even though he lay quite close to the breast and was looking at it.

Sixteenth Week.—When he saw the breast he quickly dropped the thumb to seize it.

Eighteenth Week.—When both hands were free he sucked either thumb, but chiefly the left. If the left thumb was confined in a stall, he sucked neither the right nor left.

Twentieth Week.—The child began to suck the right thumb when the left was encased; but instead of holding his hand in a closed fist, he held it open, the palm turned downward.

Twenty-fourth Week.—When the stall was transferred from the left thumb to the right, he made no attempt to suck the left, but fretted for the right. One day, he put the thumb in his mouth, then took it out and looked at the stall. The next day he looked at his thumb, which wore no stall, then put it into his mouth. After the twenty-fourth week he learned to suck the free thumb of either hand. A stall was then put on each thumb.

Thirty-eighth Week.—He began to suck the forefinger of either hand when his thumbs were tied up, holding the palm of the hand upwards.

At the close of the second year, the child still sucked his thumb.

Interpretation.

The habit of sucking the thumb is of wide occurrence among children, and a great diversity of opinion exists as to the possible effects of indulgence in it. All children who suck do not suck the thumb. Some suck a finger (usually the index or second) which may be held in various positions when in the the mouth; others suck a knuckle, and yet others a part of the flesh of the hand or arm. Nor does the habit of sucking so far as I have been able to learn from inquiry, appear to run in families, though tradition regarding it does, causing some mothers to teach it to their children, and others to try by every means to prevent its acquirement. It is generally conceded that it

'makes a good baby' of the little one to have this comforter amidst the trials of its young life. The possibility that the substitute may afford solace rests upon two significant facts: (*a*) the concentration of the early impressions around the satisfaction of hunger, and (*b*) the failure of the child to discriminate among his feelings.

It is probable that the thumb first found its way into the mouth by accident. The position of the hands and arms and their constant movement within a circumscribed limit, naturally brought them into juxtaposition with the mouth. Of all the fingers, the thumb because of its position on the hand was likely to be the one to get into the mouth, and was moreover the only one with an exposed free end.[1] The thumb, having come in contact with the lips, was, owing to the strong tendency to suck, taken into the mouth and at once made use of. Owing to the same strong tendency, the backs of the fists were sucked. But the size and shape of the thumb fitted it preëminently for the purpose. When a difference in its favor had been experienced a preference for it led to a repetition of those movements whereby it had been obtained. On the forty-ninth day we find the child getting hold of his thumb by a round-about method, the reproduction of early movements, whereas by the tenth week a direct method had been developed. By the forty-ninth day an associative link was established which connected, with the sucking complex, certain hand movements and feelings of satisfaction in favor of the thumb. By the tenth week thumb sensations had become differentiated from the sum of the hand sensations, thumb-perception and thumb-desire had been formed and thumb-habit formulated but not perfected.[2] It is noteworthy that an indisposition was instrumental in clinching the habit.

At first the thumb was used as a substitute for the mother's breast, evidence that he had as yet no idea of his own hands by which to distinguish them fully. After the tenth week sucking the hands no longer served as an expression of physical uneasi-

[1] Not more than three times was the child's thumb observed to be enclosed in the fist.

[2] Compare with stage of progress of grasping (tenth week.)

ness; but sucking the thumb became the means of obtaining comfort. The discussion of this personal habit has been carried to the point of its formation. Let us, before going further, pause to note the native elements which lay at its foundation.

1. Instinct of sucking.
2. Fœtal position of the hands.
3. Spontaneous movements of the hands and arms.
4. Peculiar fitness of the thumb.

These pertain especially to the thumb habit; to them must be added Nos. 2, 3 and 4 of the capabilities enumerated below under the interpretation of the facts relating to grasping. Such a form of activity as grasping might be declared to have developed through reflex action without intellectual accompaniment. The evidence here brought forward, bearing on the formation of the thumb sucking habit, points directly to a hedonic element at the foundation of its growth. While we may not designate this element as pleasure or pain, we may describe it as the recognition of feelings of comfort and discomfort.

Record of Hand and Arm Movements.

First Day.—During the first hour the arms were waved about towards the head and face. Later the hands, usually held beneath the chin, were closed in a fist. They clasped a finger when it was introduced into the palm; they did not clasp what merely touched the hand.

Sixth Day.—The fingers, no longer continually flexed, were sometimes extended. When nursing, the open hands lay upon the mother's breast.

Seventh Day.—The hands were often open but held near the face.

Twenty-ninth Day.—A finger was placed in a hand which the child had been sucking. He clasped the finger and essayed twice to draw it towards his mouth.

Thirty-sixth Day.—The attitude of the fingers was now peculiar, the forefinger crooked, the other three extended, or flexed slightly at the distal phalanges. The elbows were still flexed. About this date he began to grasp the clothing of the person in whose arms he was held, and to maintain his hold upon it.

Thirty-eighth Day.—Grasping and holding became frequent. He repeatedly grasped and held a fold of the mother's gown—once maintaining his hold for fifteen minutes. When a finger was placed in the hand of an arm which was waving about, he took the finger firmly and carried it towards his face. The child no longer allowed his hands to be covered, but removed them from beneath the blanket even when asleep.

Fifty-fifth Day.—He grasped whatever came within the sweep of his active arms.

Tenth Week.—He fingered things a great deal as if feeling of them. Before the tenth week the child had worn only flannel dresses, but during this week a change was made to muslin dresses. He at once began to handle these, gathering the stuff up into bunches which he could see. When the flannel dresses were put on again he did not handle them.

Twelfth Week.—Sometimes grasped with the thumb opposing the fingers. Once grasped with the thumb and index finger. In his first attempt at reaching he fixed his gaze upon an *object*, pursed his lips in attention, and moved his hand gropingly towards it.

Thirteenth Week.—Was seen to watch his *hand*, as he stretched out his arm and grasped his mother's dress.

Fifteenth Week.—He reached with an uncertain, shaky hand for a pair of scissors which he obtained twice.

Sixteenth Week—In the beginning of the week two balls of the first gift were suspended by strings above the child's bed and within reach of his arms. At first he gave no heed to them, continuing to gather up his dress in bunches. Later in the week he did notice them, reached for them with open hands, and seemed annoyed that he could not hold them.

Seventeenth Week.—He began to play with his own fingers. Reaching became more frequent. Sometimes he struck the object with the back of the hand, thereupon he turned the hand over so that the palmar surface touched it. He did not try to get articles whose distance from him was greater than the length of his arm, or if he did, he attempted to move his body toward them.

Eighteenth Week.—Hand and arm movements in grasping

and reaching still very imperfect. The hand was sometimes outstretched with a trembling uncertain movement, when it often fell short of its goal; sometimes it caught the object by a rapid sweep of the arm and firm grasp. He frequently handled the balls without looking at them or his hands.

Twenty-first Week—His feet became a favored plaything.

Twenty-fifth Week.—He objected to having them covered by stockings or bed clothing.

Twenty-sixth Week.—They invariably supplemented the hands in feeling of objects; the hands grasped the object first, the feet then went up to feel of it. One hand, or one foot rarely acted alone, though the movements were not symmetrical. One sometimes initiated the movement, but the other, unless in the mouth, soon followed.

Twenty-seventh Week.—He attempted to hold with the feet. He touched an object with an open palm as one feels of a flat surface. But in taking hold of the balls he passed his fingers under them.

Thirtieth Week.—He drummed on the table of his chair, holding a spoon or 'gum ring' in his hand.

Thirty-first Week.—He amused himself by grasping between his first and second toes the leg supporting the table of his chair, which he alternately lifted and let fall so that it rapped upon the floor.

Thirty-second Week.—He tried for the first time to grasp with his whole hand a very small object—a fly. He reached for the fold of the table cloth which droops from the corner of the table, his hand conforming in its attitude to the form of the fold.

Thirty-third Week.—Before the thirty-third week the child had never been seen to use the two hands for different purposes at the same time, with the exception of the occasions upon which he sucked his thumb, when the other hand usually fingered something. One day in the thirty-third week he was holding a napkin ring up to his mouth, when a bearded face was thrust in front of his. He gazed upon this for a few moments, then, carefully taking the ring in one hand and slipping the other out, he reached for the beard, continuing to bite the ring.

In this week he ceased to use his feet for playthings, but

continued to use them in reaching and feeling. When given an orange he handled it much as he did the balls, with evident appreciation of its form.[1]

Thirty-fourth Week.—The separate use of the hands had become a habit, but he could be seen to show no preference for one hand over the other. He regarded his hands with a fresh interest, holding one before his eyes, opening and closing the fingers. The forefinger was separated from the other three and used independently; it was often held open when the rest were closed, as though in the attitude of pointing. In this week he used separately the index and thumb, and three other fingers; grasping the lips of a person with his whole hand, he maintained his hold with three fingers, while with thumb and index he reached after the nose, which he held also.

Thirty-sixth Week.—He failed to reach a dish, though he leaned forward as far as he could and stretched his arm to its full length. He then took up a spoon and succeeded by its help in touching the dish.

Thirty-eighth Week.—He twice imitated actions of his mother. Holding two spoons by their handles she clapped the bowls together till they rang. The child reached for the spoons and awkwardly copied the action. His mother then did it a second time, upon which he reached for one spoon which he took in his left hand. In order to get the second he passed the first on to the right hand, and took the second in the left. He now held them in such a way that the bowl of the second spoon projected beyond that of the first; he then raised the first spoon till the two were even, after which he clapped them together.

Thirty-ninth Week.—He now felt of objects with his forefinger, holding the other fingers flexed.

Forty-first Week.—Before taking hold of an object he looked it over carefully, then grasped the smaller part, which he could

[1] The study of the accommodation of hand movements and attitudes to the various objects handled is capable of far wider investigation than I have given it. Through it may be gained much insight into the growth of the perception of form. In my work I trusted to a series of instantaneous photographs, merely noting movements in the journal and not describing them fully. It is greatly to be regretted that the photographs, owing to a fault in the films, proved worthless. Hence this important subject cannot here receive the consideration which is its due.

easily hold in his hand (tail of a toy cat, handle of a dipper, etc.).

Forty-fourth Week.—In trying to pick up a small thing, such as a piece of thread or a bread crumb, he first pointed at and touched it with his forefinger, then withdrawing the flexed hand a short distance, he made a downward dart with the now open hand, which he closed over the object. Usually the first attempt was not crowned with success; but be repeated the action till its end was attained—often as many as six times. He occasionally picked up a small object with his thumb and forefinger; by the fifty-second week this method had entirely superseded the other.

Forty-seventh Week.—He reached after the coffee-pot with a spoon, which he hooked in the handle, and drew the pot towards him.

Fifty-sixth Week.—The forefinger used less markedly. The hand in general employed with more skill.

Seventy-second Week.—At this time he fed himself with the left hand.

Eighty-eighth Week.—The child was observed sitting on the floor, holding a magazine between his legs, and letting the pages slip from between his thumb and forefinger as he viewed the pictures. The forefinger was used in pointing out objects and persons.

Ninety-first Week.—He still looked at his outstretched hand. Upon one occasion, after pointing to an object, he regarded his hand reflectively and said, "see an!" (see hand).

Ninety-third and Ninety-fourth Weeks.—Observations and experiments failed to reveal a development of right-handedness. Experiments showed a slight but inconclusive preponderance of actions of a certain class in favor of the right hand.

Ninety-fifth Week.—He learned to throw a ball overhand, and to make marks with a pencil on paper. He experienced considerable difficulty in holding the first and second fingers together and separated from the rest.

One Hundred and Fifth Week.—In performing difficult actions with the right hand and arm, the child gave evidence of being right-handed.

INTERPRETATION.

Immediately after birth the baby's hands were not organs of prehension at all. They went forth to meet nothing and did not even close over what came into contact with them, unless it was actually thrust into the palm. In the twelfth week his hands became true organs of prehension; for they were then able to get what was perceived through the sense of sight. The steps by which the child gained the power to use his hands may be described as follows: As the first one, there was the inborn ability to clasp, or close the hand—the instinct of clasping. Sensations of touch and movement ensued upon the exercise of this inborn ability. By the alteration of the attitudes of the hand from pre-natal to post-natal ones, a larger surface was exposed, increasing the area for stimulation. Sensations of contact from all parts of the hand ensued. Spontaneous movements of the arms brought the hands into various situations and contacts. The change from pre- to post-natal arm attitudes gave a different quality to arm movements. A sweeping motion of the fully extended arm then became more common. Holding, or the continuation of the action in the presence of the stimulus, as opposed to mere clasping, was next developed.

He experienced new muscular sensations induced by resistance encountered when he tried to draw towards his mouth the object which he had clasped. Sensations of touch from all parts of the hand were bound by association to the act of clasping in such a way as to insure the clasping of anything touching any part of the hand. After this the hands clasped whatever they were brought into contact with by the activity of the arms, in other words, not only what came to them, but also that which they went out to meet. In the tenth week he reacted distinctly to differences in sensations of touch received through the hands.

In opening and closing his hands on the material which caused the change of sensation, and in flexing his elbows, he carried bunches of the material into his field of vision. Sensations of sight were then experienced in company with those of muscle and skin. At this time the child had already developed by other experiences some perceptions of things seen and some appreciation of direction and distance.[1]

[1] Consult Part III., Sec. 2, of this work.

Hereafter the child frequently saw his hands in conjunction with objects clasped, a constant element in every vision. In his first attempts at reaching, the child fixed his gaze on the object, and not on the hand, guiding the hand and arm entirely by standards of movement which were established before he could sit up, or had seen his body and limbs. In this connection it is interesting to note that as late as the sixth month he took pleasure in playing with objects that he did not see.

In the thirteenth week he began to watch his moving hand. After this he was able to reach after and grasp, though as yet very awkwardly, something held within a suitable distance.

If the foregoing interpretation of the process of the growth of reaching and grasping be the correct one, we may assume the following capabilities and conditions to have existed in the child as a basis which made the growth possible (but did not cause it), namely:

1. Instinct of clasping.

2. Capability of receiving sensations of touch and movement.

3. The tendency of one or more terms of a series composed of sensations which have been felt together, or in conjunction with the mental representative of a movement, to call up the other term or terms.

4. Physiological law of habit.

5. Range and variety of movements conditioned by the modification of the fœtal attitudes which were maintained by the child.

If we examine the later history of hand movements and a further development of the thumb-sucking habit, they are found to have, respectively and in common, some significant points.

Between the thirteenth and sixteenth weeks occurred the perception of the hand as distinct from other objects. By the sixteenth week his thumb no longer afforded satisfaction as a substitute for his mother's breast. In the seventeenth week he took an interest in the hands for themselves, using them as playthings. At this time he usually reached with both arms, though he sometimes, as when sucking, used one hand alone. Nevertheless, he was not aware of the number and separateness

of the hands, as was shown by his actions when one thumb was tied up in a stall.

In the twenty-sixth week matters were further complicated by the addition of the feet as organs of touch. I was at first inclined to regard this peculiar feature of the use of the feet as a rudimentary instinct, inherited from the remote past, and suppressed in most children by the custom of keeping the feet encased. But later a review of the rise, continuance and decline of the practice led me to discard the earlier opinion. As soon as the weather permitted, the child ceased to wear stockings, and, dressed in light warm clothing, he was allowed every freedom of movement. His whole body was now in constant motion, so that in a short time he inevitably discovered his feet (21st week). The hand had then acquired no extraordinary skill, but was occupied in feeling objects of various kinds, so the feet were able to do their share, also coming in contact with numbers of things. It is true grasping still belonged to the hand; but it must be remembered how extremely imperfect a form of grasping it was. To have and to hold was not its purpose, nor had the child perceptions of objects upon which to base a desire for them. However, as the hands became more skillful the office of feeling was delegated to the feet, which invariably felt of that which the hands held. With the development of hand movements, and the acquirement of the habit of sitting erect, such use of the feet gradually ceased, till it had largely disappeared.

Development of hand movements after the twenty-fourth week may be summarized as follows:

The separation of the sensations of each thumb, and the formation, of a representation of each individual thumb, accompanied by increased dexterity in its use; the separation of the forefinger sensations, and the formation of a forefinger idea, accompanied by increasing dexterity; the differentation of hand and feet sensations, the growth of a hand-idea, accompanied by the growth of perceptions of things seen and handled, with consequent desire to get and to handle, and increased dexterity of hand and arm movement; the differentation of the sensations of each hand and arm, then of the index and thumb (for uses of grasping), and the growth of the corresponding ideas.

In the thirty-eighth week the first decisive acts of conscious imitation were observed. These showed a possible recognition of a likeness between his own hands and those of another person. In the thirty-ninth week came the concentration of the sensations of touch in the index finger, and (forty-fourth week) the consequent development of a peculiar method of picking up small objects. This method was finally superseded by another older and less awkward one. After the fifty-second week development was along the line of a greater perfection of the movements acquired, and was conditioned, nay called forth, by the child's experimentation with things and his attemps at conscious imitations of the actions of other persons.

SECTION II.—VOLUNTARY MOVEMENTS.

Record.

Fourth Day.—If some one kissed the hungry child, or touched him on the cheek, he turned his open mouth towards the side touched.

In the second week the child, when hungry or uncomfortable from any cause, opened his mouth and rolled his head from side to side, as when searching for food. This he did, also, if the breast slipped from his mouth.

Seventeenth Day.—Wishing to regain his hold of the breast he turned his head towards it, instead of rolling the head from side to side.

Thirty-seeond Day.—Turned the head in the direction whence sounds proceeded.

Thirty-seventh Day.—He held objects which he clasped.

Thirty-eighth Day.—Mr. C. called, and the baby looked attentively at him. When sitting on his mother's lap he made vigorous and repeated efforts to hold his head erect in order to see this visitor. His whole body quivered with the exertion.

Fifty-ninth Day.—If the child lost his hold upon the nipple, with open mouth and eyes fixed upon the breast, he made 'reaches' with his head and neck till he succeeded in regaining his hold.

Tenth Week.—Having learned to suck his thumb, he returned it to his mouth as repeatedly as it was taken away.

Twelfth Week.—Persistent attempts at reaching and grasping. Efforts to raise his body from a reclining to a sitting position became common.

Seventeenth Week.—Attempts at turning the body over.[1] He tried to get a ball to his mouth, and was annoyed at his failure to do so. He held his head erect, turned it to the side through an angle of 90°, and raised his eyes to the face of one who had spoken to him.

Twenty-second Week.—When he saw approaching, the spoon from which he received his water, he opened his mouth, then seized the spoon in his hand and pulled it towards his face.

Twenty-fifth Week.—In trying to draw the breast to his mouth he put his hand over the nipple. When he found that it was not the nipple which came to his lips, he drew back, looked at the breast for a few moments, then removed his hand and seized the nipple between his jaws as usual.

Twenty-ninth Week.—The child expressed his desire for food by pulling at his mother's dress.

Thirty-third Week.—At noon he derived great pleasure from playing with an orange which had been given him by his father who held the child on his lap. In the evening he saw some oranges in the fruit dish on the sideboard, and at once manifested excitement by the usual signs. He looked from the fruit to his father a number of times, making sundry little noises. The action was evidently expressive of desire, and he was much pleased to have an orange given to him.

Thirty-fourth Week.—The child had a spoon to play with, and was deeply interested when his father extended his hands to take him up from his chair. He looked at the hands, holding out one of his own; but when about to extend the other he turned away from his father to the spoon, withdrawing the one already given. Then he looked back at his father, and again started to give his hands, but once more turned away. This

[1] I refer to such actions here in order to show what the habitual actions were in the acquirement of which the child was occupied, or which when established entered into voluntary actions.

performance was repeated three times, until in a longer contemplation of the hands he seemed to forget the spoon.

Thirty-fifth Week.—He threw down a spoon, to which a string was attached. His mother put the string into the hand with which he was slapping the arm of a chair. The movement of his hand caused the spoon to rap upon the floor. The noise surprised him, and he continued to slap, seeming to think that his hand on the arm caused the sound. Afterwards he discovered that the noise could be made when his hand was extended beyond the chair, and holding the string in hand, he began to beat the air with a downward motion, as if hitting something hard. Only occasionally did the spoon rap upon the floor.

Thirty-sixth Week.—Conscious repetition of one of his own sounds quoted by an older person for his amusement.

Thirty-eighth Week.—Conscious imitation of an action, the result and not the act being the end in view, (see hand movements p. 18).

Fourtieth Week.—The spoon with which he was playing fell through the rounds of the back of a chair which was lying on its side in front of him. He was about to cry at its loss, but did not do so, and tried to get it. The first attempts were unsuccessful, for he put his arm through the wrong opening, and each time his hand was too far from the spoon. Finally he found the opening nearest to the spoon, which he recovered. The child succeeded a number of times in pulling himself to his feet by the aid of a chair, each successful attempt alternating with three or four unsuccessful ones.

Forty-first Week.—He now took hold of the far end of an object to pull it towards himself, instead of touching it with his finger tips and pushing it farther away.

Forty-second Week.—Intentional but unintelligent repetition of syllables and words.

Forty-sixth Week.—Creeping became a habit. When the child was carried into a room in which someone had hidden, he, when told to do so, went in search of the person, whom he located by the sound of a voice emanating from the hiding place. On the fourth trial his mother threw a wrapper over a chair, fastened it, and hid behind the chair. When the child

reached the chair he tried to pull the wrapper down as he had previously done with a quilt, but found this impossible to him. He sat a few moments as if in thought, then crept around the chair.

Fifty-second Week.—Request for food expressed by extending first one hand and then the other.

Fifty-eighth Week.—The child, who was sitting beside the kitchen table while the vegetables were being prepared, was given pared potatoes to drop into a pan of water. He knew from past experiences that his mother would not permit him to put them into his mouth. He looked at his mother, and if her face was turned away, slyly put the potato up to his lips.

Sixty-first Week.—He succeeded in walking alone.

Sixty-fourth Week.—He took hold of the finger and led one to a door out of which he wished to pass, or went behind and tried to push one along. Expressed his desire to be taken up by pulling at ones clothing.

Seventy-third Week.—He was one day walking behind his parents as they were leaving the grounds in which the buildings of the U. S. Fish Commission stood. Four separate gates led into these grounds, two small ones on the foot paths, and two large ones on the carriage ways. The child in his carriage had passed in and out of each gate many times in two months. The path on which they were walking was separated from the roadway by a grass plot and gutter. His parents passed out of the gate and closed it. When he perceived that the gate was closed, the child started across the grass towards the large gate, which stood open. Arrived at the brink of the gutter, down to which the grass plot sloped in a short, steep incline, he hesitated while glancing from the incline to the small gate, then turned quickly and resolutely back across the grass to the path, and walked to the small gate which he opened and out of which he passed.

Seventy-fifth Week.—In an adjoining room he found two pins, things which had always been taken away from him. He hastened at once to his mother with them, calling, "mamma! mamma!" in a tone of excitement. He gave them up freely; but cried bitterly to have them taken away.

Seventy-eighth Week.—The acquirement and practice of new words occupied him at this time.

Eightieth Week.—The child stood his bottle on the floor, then tilted his doll over it to take a drink.

Eighty-second Week.—He accidentally broke the head of his wooden horse. He took the head to his mother, led her to the horse, pulled her down to the floor and awkardly put the head and body together as a sign that he wished her to mend it.

Ninetieth Week.—When called into the bath room, to get ready for a bath, the child invariably seated himself on the floor and held out his feet to have his shoes taken off.

Ninety-first Week.—He got a cloth and imitated his mother in polishing the piano. 'Contrary' actions became more common. They increased in frequency up to the beginning of the twenty-fourth month. At the close of the twenty-fourth month they became less frequent, the child, understanding language better, became more amenable to verbal suggestion.

Ninety-ninth Week.—Seeing his mother fitting a collar, he took a triangular piece of cloth, put it around his neck and said, 'fit!' Wiped his nose with the same and called it a handkerchief, spread it out and called it a table cloth.

One Hundred and First Week.—Sometimes he gave expression to his purpose before acting. Acts of conscious imitation began to predominate.

One Huudred and Fourth Week.—Actions suggested by association became very prominent, for example, when taken into the kitchen and placed on a certain chair, the child demanded a book which had been given to him but once, three weeks before, when sitting on the same chair.

Interpretation.

If it be true, as I believe the evidence adduced in this paper proves, that voluntary action rises out of the performance of instinctive action, we should seek to find the first voluntary movement not in the first deliberative act, nor in the first act of conscious imitation, but in the repetition of an act which had originally caused either a cessation of discomfort or a sense of gratification. This act may have been performed from one to thirty times before it contained an element of volition. But

when an associative link had been established between some mental representative of the movement and the feeling of satisfaction, so that the movement was made in the attainment of satisfaction, the movement was to be regarded as a voluntary one. No idea of the effect of his movement considered as a cause is to be imputed to the child. On its intellectual side this primitive act of volition must be divested of representation and choice, and regarded, thus stripped of that which we are accustomed to think of as belonging to volition, as an extremely simple response to a suggestion by which it was initiated. To make this statement more clear I would refer the reader to the record of voluntary actions. On the fourth day it was recorded of the child that if touched on the cheek he turned his open mouth towards the side touched. This the newly born baby did not do. Each time that he was to be fed the child was laid in a certain position, and the nurse, taking his head between her hands, turned it slightly to one side in order to put his lips against the nipple. On the fourth day the child had gone through the experience some thirty times as a preliminary to the satisfaction of hunger. On the fourth day he repeated the act of his own accord. But he could not have had in mind a definite desire, impelling him to make efforts to obtain his mother's breast, or even food, since, in the discussion of the thumb sucking habit, it was clearly shown that the child had no differentiated representation of his mother's breast prior to the sixteenth week, and as he was satisfied to suck when hungry without receiving milk, it could have been no demand for food ,thought of as such, which prompted him. The act was the representative of one of several contiguous links. But this is not volition, it may be argued. What is volition but action under the stimulus of an idea? True, the associations were not ideas, nor connections between ideas. But there were no real ideas existing thus early in the life of the child; and it must never be lost to view in this search for beginnings, that the words and definitions framed to fit a psychology of the adult mind, must suffer a little expansion if they are to be used at all in describing that which is most primitive. It must be borne in mind that these associations are, on the intellectual side, the forerunners of percep-

tions, representations and finally of concepts, to all of which they are genetically related.

I have called the first stage of the development of voluntary movements the associative stage. Certainly all actions of the first three weeks belonged to it exclusively, and throughout infancy, movements belonging to this class continued to be made every day. The perceptive stage was the next to be developed, and was ushered in, when, through reiterated experiences, it was possible for the child to have some perceptions of the objects which acted as stimuli to the various departments of sensation. The action recorded of the child on the thirty-eighth day belonged to the class of voluntary actions performed under the stimulus of a perception. To this class also belong those efforts of the child to reach and handle the many objects which he saw. When it was possible for him to form an abstraction, some idea, however incomplete, of a thing, an action or an experience, this idea without the mediation of a direct sensory stimulus, served to initiate action. Volition had then reached the representative stage.

According to this view the voluntary actions of a given period were made possible by the forms of activity already developed, and consisted in an application and extension of these forms to present conditions, which application and extension by no means implied an understanding of the conditions. Before going further, I wish to emphasize one point, namely, that nowhere did I find, through the whole series of observations, numbering hundreds, a single instance of an action of which it could be said, here entered a new force, for here was an action without antecedents. The only actions without antecedents were those movements for whose performance the nervous and muscular mechanism was prepared at birth.

In order to facilitate a comprehensive view of the actions recorded as voluntary they are divided into four classes:

1. Those which had their origin in an instinct or an instinctive desire, and their end in automatism (or habit) after the action had, by means of endeavor and experience, reached a degree of perfection. To this class belong such as balancing the head, standing, walking, etc.

2. Actions in which the child made use of acquired dexterity of movement to accomplish some aim. They may be considered characteristic of the individual on the one hand, and on the other, regarded as reactions to a personal environment. They do not necessarily become habitual. Within this class belonged those actions which involved inference, deliberation and choice.

3. Expressive actions, gestures which tend ultimately to become habitual. To this class belong such as the one in which he pulled his mother by the dress to get her to accompany him.

4. Actions reproduced upon suggestion. The suggestions proceeded either directly from another person, from an object or from earlier experiences called up by association. These actions became very common when the child had some command of language. They did or did not become habitual, according to the conditions in which the child was placed. Acts of conscious imitation should be included in this class.

The persistence everywhere displayed by the child was extraordinary, but most so when he was learning to perform movements belonging to the first class.

It is noteworthy that actions of the second class should have occurred *before* those of the third; the latter appeared towards the close of the first year and reached their largest numerical proportion before the child had acquired a command of language. It is profoundly significant to psychology and pedagogy that a child may be led to acts involving inference, deliberation and choice, through his experiences with himself and things. I was surprised upon being confronted with this fact, and when, at the close of the second year, the whole subject of voluntary actions was reviewed, it would seem that the child had performed acts of greater complexity at an earlier period. It occurred to me then that such might have passed unnoticed amid the multiplicity and diversity of the actions of later infancy. I therefore set for myself the task of looking for them. For days I did not observe one. The whole character of the child's performances had changed. Everywhere some suggestion from without or from within controlled the direction of activity. The difference was apparently in favor of the earlier

performances; but not really so, for the later acts, in being the expression of thoughts or symbols, marked a great advance, while in the earlier ones inference and choice dealt, not in the symbols for things, but with the things themselves.

In the later half of the second year it became possible for a purely mental stimulus to arouse an inclination towards action. Then the strange period of perverseness, through which so many children pass, developed.[1] At the time of the appearance of this phase, the child acted almost entirely from suggestion through association. Hence when a certain course of action was proposed, the representation of the opposite course was at once called up and appealed to him with some force, since the ability to perceive the consequences of either act was as yet undeveloped. The child never expressed (in contrary mood) the mere negation or refusal; *he proposed an alternative.* Frequently, though not always, the representation did not prompt to action, and fell away upon the repetition of the suggestion. If, however, one agreed with him, saying: 'Well, we shall do as you wish,' he often burst into tears, demanding that the original plan be carried out, and thus showed the side on which the preponderance of desire hung.

The movements of expression arose almost without exception before the child had learned to express himself easily in language (between the sixth and twenty-second months); but after he was old enough to try to make his wishes known, and, persisting after he had learned to speak, they were frequently used to emphasize his demands. A description of the rise of one will elucidate the method by which all originated—a method analogous to that which obtained in the early stages of language development. In the twentieth month a gesture of dismissal which consisted in a lateral, chopping motion of one or both arms, became habitual. It was made in imitation of the sweep of the arm by which his mother brushed away the flies which came around the food. At first he copied the action, exclaiming "ly! ly!" (fly, fly). Next he applied it to food which he wished to refuse, then used it to sweep away any unpleasant object or distasteful proposition, and finally added the words,

[1] Contrary suggestion, Baldwin, *op. cit.*, p. 145.

'take it away,' (object), or 'good bye,' (proposition). As associations between representations multiplied, the child daily performed a number of actions dependent thereon, and even performed them regularly in a mechanical sort of way after they had lost the power to entertain him. He objected to slight deviations from the regular routine, such as washing the feet before the hands.

He was never given to that quality of conscious imitation which at once attempts to reproduce what others are seen to do. Acts of conscious imitation did not begin to play an extremely important part till he had gained some understanding of the meaning involved in the actions of others, then he was ever ready to do his share.

SECTION III.—INHIBITORY MOVEMENTS.

Record.

Third Day.—He frequently started at loud noises and ceased crying.

Twenty-fourth Day.—The striking of a clock caused him to stop crying.

Thirty-eighth Day.—The voice of his father caused him to stop crying.

Forty-first Day.—Interesting sights diverted the child's mind from personal discomforts, great enough to cause crying.

Forty-sixth Day.—The sound of rattling spoons caused the child to stop crying.

Fifty-fifth Day.—The child, who had been held more than usual during the second month, cried, on the fifty-fifth day, when laid down. When no one responded, he ceased crying and became pleasant.

Tenth Week.—Inhibition of crying was of frequent occurrence; the child often stopped with his face made up to cry, the cry being lost in the active contemplation of some interesting performance.

Eleventh Week.—If the hungry child was fretting, he stop-

ped as soon as he saw his mother begin to unfasten her dress, looking at her with wide open eyes, and breathing quickly.

Eighteenth Week.—When his thumb was encased in a stall, and he had found that it was not good to suck thus, he held his hand quite still at his side.

Nineteenth Week.—Th child upon waking from a nap, twice raised his thumb almost to his mouth, then put his hand down.

Twenty-eighth Week.—For two days in succession the child who had before been held at the table during the meal, cried, and was taken to the dinner table. The third time he cried, (two days having intervened) this was not done; but he was permitted to cry until, of his own accord, he stopped. After this he did not cry again[1] upon seing others go to the table.

Seventh Month.—The child liked to play with a spoon, with which he pounded upon the table. When he became tired of this occupation he put the spoon in his mouth and invariably poked it so far down his throat that he choked. After he had played with a spoon for a month, and choked himself times without number, he in the thirty-sixth week learned not to do so any more, though he frequently put the spoon in his mouth.

Thirty-ninth Week.—Having acquired the habit of sitting alone, the child, sitting on a quilt on the floor, plunged forward after a toy and fell off the quilt on his face, severely bumping his nose. Thereafter he was never seen to plunge forward after a lost toy, though before he had been hurt in falling, this performance had been one of almost hourly occurrence.

Fifty-seventh Week.—The fear of falling having become associated with experience in a more general way, the child learned to take better care of himself by controlling his heedlessness; but a strong desire was still sufficient to submerge all prudence, as when seeing his cup on the floor, he would have plunged headlong off the bed after it.

Seventy-ninth Week.—His hand was extended to take from the wash-stand a mug, which he had never been allowed to have. The sight of his mother, who upon several occasions

[1] The question here arises as to whether crying is itself unpleasant to the child. There seems to be ground for believing it to be a direct source of discomfort.

had taken the mug away, was enough to cause him to withdraw his hand.

During the latter half of the second year the child learned to control himself in several directions. He could, and very frequently did, cease crying when told to do so. (No form of punishment had been inflicted upon him to teach him not to cry.)

When running at headlong speed he frequently failed to see a table or other piece of furniture till close upon it. Then he could draw up so shortly that one could see no space between his head and the table edge, yet escape the least blow. It was often a matter of surprise that he received so few real hurts. This was to be attributed partly to the ability to guide himself around dangerous places, partly to the power of control which enabled him to call a stop at instant notice.

Through training the child had acquired a certain amount of voluntary control, inasmuch as he often inhibited certain actions, though the desire to perform them must have been strong. In the twenty-third and twenty-fourth months, having learned to throw his ball overhand, he took delight in throwing everything which he could lift, from books to his little chair. At this time he was especially fond of sitting beside his mother's desk, playing with her letters, etc., while she was writing. He almost always threw each article away in a few moments. This practice could not be permitted; hence he was deprived of the pleasure of sitting in the high chair, a severe punishment, causing many tears to flow. He was often observed to stay his hand in the very act of throwing, and instead pass the things to his mother. When the child was enjoined not to touch something—the table set for a meal, for example—he could restrain himself if not too long exposed to the temptation. If, however, he yielded at all, it was altogether. He would then run around the table, taking everything within his reach, and finally pull off the cloth.

Interpretation.

Inhibition was first induced by a sense stimulus, which in drawing attention into another channel caused a movement already in progress to cease. As other forms of inhibition

arose this, the sensorial one, did not disappear. It was used by the persons who dealt with the child, who endeavored to stop his crying and prevent the performance of various acts, by bringing forward attractions by which to stimulate sensation. Thus it became related to suggestion. The inhibition of crying was the first conspicuous manifestation. Very soon (eleventh week) a perception in which was involved memory of an agreeable sensation induced the cessation of crying. Later the recollection of an unpleasant experience caused the child to pause in the performance of a voluntary movement. These were the steps by which inhibition, occurring first as a response to a counter stimulus, ultimately became, as it were, engrafted upon voluntary action. In its early stages inhibition did not occur with an extensive range of actions; but was developed along with special forms of activity. Experience taught the child what and when to inhibit. Sometimes the lesson of experience was learned only after a long course of training; sometimes a single hard lesson sufficed to define a boundary of control.

The cases cited in the record serve to show how intimate a relationship existed between inhibitions and the acquirement of bodily control and dexterity. If we consider them in connection with this relationship we find ourselves once more in the territory of habitual and voluntary movements.

SECTION IV.—SOME AUTOMATIC MOVEMENTS.

Record.

In the early weeks of life perfect repose during sleep was rare. Starting, movements of the hands and feet, low noises and brief fits of crying disturbed the slumber of the child, especially during the day, when the noises of the street exerted their influence also. About the sixth week sleep began to be more peaceful; gradually the child became a quiet sleeper, except when uncomfortable from some indisposition.

Thirty-ninth Day.—The child, by this time, objected to having his hands covered, and even when asleep removed them from beneath the covers.

Twenty-third Week.—When a steam siren blew, which had previously awakened him, the child cried out in his sleep without opening his eyes.

Twenty-fifth Week.—With eyes tightly shut, the sleeping child, lifted from his crib, could find the breast quickly and suckle as well as when awake. As soon as satisfied, he fell back, his body stiffened, as if prepared to be laid down. He objected to the covering on his feet, and invariably kicked it off when asleep.

Thirty-second Week.—Having, by dint of repeated efforts, learned to roll on the floor, the child in the thirty-second week began to roll in his crib during sleep.

Thirty-eighth Week.—When the thumbs were tied up the child sucked a forefinger. This he never did in sleep, though under the same circumstances he would have taken his thumb.

Fortieth Week.—The sleeping child, after having been fed, lay across his mother's knees while his clothing was arranged. A pair of slippers was on the bed beside them. He stretched out his hand and encountered a slipper, which he grasped and carried to his mouth, babbling as he did so. During the performance his eyes were closed. He then opened his eyes, looked for a moment at a light in the next room, let go of the slipper, closed his eyes and was immediately asleep.

Forty-fifth Week.—In the fortieth week he learned to suck milk from the bottle. In the forty-fifth week he was not able to fall asleep while doing this; but within a week it became possible to him to do so. Then the bottle was given to him at 10:30 P. M., when he was sleeping. Upon being disturbed he put up his hand as was his wont, to his mother's neck, but receiving the bottle he carried it to his mouth and drank the milk. This performance was the more noteworthy as the rubber nipple sometimes collapsed, making it necessary that the child should release it in order that it might be refilled by air and milk, a trick which he had learned only after some practice.

Fifty-fifth Week.—The child had acquired the habit of pulling his own ear or that of another person while sucking his thumb. When disturbed, but not awakened, he immediately put his thumb into his mouth and began to pull his ear.

SECTION V.—MOVEMENTS OF EMOTIONAL EXPRESSION.

Record.

First Day.—When uncomfortable the child cried.

Sixth Day.—Smiled when comfortable.

Seventh Day—Smiled at his father four consecutive times, accompanying the smile with movements of the arms.

Tenth Day.—Tear secretion observed for the first time.

Seventeenth Day.—Fretting—a sort of cry—expressed discomfort.

Twentieth Day.—Smiling at persons became more frequent, and the smile more intelligent.

Forty-sixth Day.—Laughed aloud upon several occasions (at persons.) The laugh consisted of a smile accompanied by a sound caused by alternate expiration and inspiration; it did not resemble the coördinated laughter of the later months.

Fifty-fifth Day.—Displeasure indicated by hard crying and rigidity of the whole body, which was so complete that if taken by the hands he could be raised to his feet without having bent the vertebral column and lower limbs.

Sixty-first Day.—Pursing of the lips accompanied fixed attention.

Tenth Week.—Rapid, alternate flexions and extensions of the limbs in excitement were first observed in this week.

Twelfth Week.—Kicking and waving the arms became the habitual method of venting excitement, and were sometimes accompanied by pursing of the lips. While on a journey a phenomenon was noticed for the first time which afterwards occurred frequently; namely, the retention of the urine during an exciting experience. Six hours was the longest period during which the urine was retained, but throughout the journey the intervals were uniformly longer than they had hitherto been. From the twelfth week to the close of the second year the child never visited a new house, saw visitors at his own home, became deeply absorbed in any occupation or plaything without the occurrence of this phenomenon. After

the ninth month excitement interfered with evacuation of the fæces also. By the twelfth week the voice had become more expressive of the child's states of feeling.

Thirteenth Week.—Expectancy (of food) accompanied by a quivering of the body and sundry little noises.

Sixteenth Week.—Tear secretion was established. When hurt he began his cry with a loud, explosive 'Mä-ä.' When getting hungry or sleepy he fretted, and gradually broke into a cry. Sometimes his eyes filled with tears preliminary to the utterance of a cry. Sometimes he first drew down the corners of his mouth and whimpered. Great excitement in novel experiences was accompanied by protrusion of the lips, wide opening of the eyes, during forward inclination of the body, reaching with the hands, rapid movements of the arms and legs, trembling of the body and especially of the arms and hands, and accelerated respiration. In surprise his eyes were widely opened.

Eighteenth Week.—When suddenly surprised the child started and threw out his hands. In a broad smile his whole scalp was seen to move. A broad smile, with wide opening of the mouth, expressed extreme pleasure. Frowning accompanied great effort. General repose of the face indicated bodily comfort. Grunts accompanied by a twisting and turning from side to side indicated bodily dissatisfaction. It is doubtful whether the child had ever felt fright.

Nineteenth Week.—Writhing and twisting of the body expressed delight.

Twenty-fourth Week.—Kicking and laughing accompanied pleasure. Good health and high spirits found vent in loud laughter and occasional screams.

Twenty-fifth Week.—Disappointment (when not taken out of doors) indicated by fretting and scolding. Vigorous kicking in which the feet were used alternately, indicated excitement. The rythmical striking of one foot against the other leg indicated displeasure. The rapidity of the movements seemed to be a measure of the strength of the feeling. In hard crying he rolled his body from side to side, or held his legs raised and rigid, but flexed slightly at the knees.

Thirtieth Week.—The movements made during displeasure became rythmical. They consisted in turning the body to the side, succeeded by the recovery of the first position, or throwing out and drawing in the arm, or in the flexion and extension of one leg. It was customary for him to repeat the action again and again at short and regular intervals. The child was observed to frown when slightly annoyed.

Thirty-third Week.—He acquired a new form of smile, which gradually but not entirely supplanted the broad, open-mouthed smile referred to above. The nose was wrinkled up, the eyes nearly closed, the angles of the slightly parted lips were drawn backward, and the jaws were approximated. This smile seemed to express an extreme and more conscious enjoyment. For a long time it was never observed in the presence of strangers.

Thirty-fourth Week.—When sitting had become a habit, vigorous kicking as the outlet of enjoyable excitement gave place to a jumping up and down of the whole body. Frowning as an expression of displeasure became frequent and persisted.

Forty-third Week.—Delight was expressed by a piercing scream, accompanied by flapping of the arms and rubbing of the feet back and forth upon the floor.

Forty-sixth Week.—Delight was expressed by a shiver such as might accompany a sudden chill.

Fifty-second Week.—He no longer shivered with pleasure; this habit he had gradually abandoned.

Fifty-fifth Week.—A mischievous look was seen for the first time. Thereafter it was frequently observed.

Seventy-eighth Week.—Shyness was indicated by hiding the head. The squarely open mouth in crying was observed. It had occurred earlier, but I neglected to record its first appearance.

Eighty-Seventh Week.—In fits of temper, which were provoked by attempts to force his clothing upon the child, and to make him go in a given direction, he struggled and bit. This practice lasted but a few weeks.

One Hundred and Fifth Week.—At the close of the second year, in the excitement of pleasure, the child stamped rapidly

and alternately with each foot, his hands trembled, his eyes sparkled. Finally, as though he could contain himself no longer, he often ran round and round the room as fast as he was able. He smiled frequently; but loud laughter was not usual except when playing with other children, or his elders. In crying, the habit of drawing down the corners of the mouth had largely superseded that of opening the mouth squarely. Throughout infancy, as in adult life, the voice was the chief instrument of expression; but I have here omitted to treat of it because it would be impossible to transcribe its many indications of feeling changes; and for the further reason that the growth of the ability to use the voice is alluded to under Language.

Interpretation.

In treating the subject of movements of expression my only aim is to describe the prominent features of the changes which took place during the development of the child. In the early weeks the facial expression varied greatly from hour to hour. The continual changes were not due to definite emotional causes, but resulted from spontaneous movements of the muscles of the face. When the child's attention was deeply engrossed, he was comparatively still, for the spontaneous movements then partially ceased. During profound sleep, also, the muscles of the face were more quiet than in a light sleep. While awakening, which sometimes required so long a time as half an hour, the changes in facial expression were most marked.

The question of the first smile is one which has led to much discussion. The popular belief seems to be that any smile occurring before the child is a month (some say six weeks) old is due to pain resulting from digestive disturbance. My observations point conclusively to the erroneousness of this belief (as applying to one individual.) Prior to the fifth week the child smiled but rarely. On and after the fifth week smiles were often to be observed. The first smiles were clearly different from the later ones. They were produced by the muscles around the mouth; the muscles around

the eyes did not participate noticeably. They were extremely evanescent. They occurred under the following circumstances: (1) Almost invariably when the child, having been fed and laid in a comfortable position, was peacefully dropping to sleep; (2) During the light sleep which succeeded a deep and restful one, and occasionally during all sleep; (3) Occasionally at persons. They never occurred when the child was known to be in pain. The smile changed with the expression of the face, the two gaining in the appearance of intelligence. Finally the whole face, and even the scalp, seemed to unite in producing a smile. When the intelligent human smile had quite superseded the earlier form, it occurred like its predecessor, when the child, in perfect comfort, was sinking into sleep.

I may now briefly summarize a few other facts taught by the observations. 1 It will be seen that there existed at birth no well defined movements of pleasurable expression, for, even the smile, observed within the first week, has been challenged to prove its right to that office; on the other hand the method of expressing displeasure, discomfort and pain was perfected at birth. 2 The method of expressing pleasure or pleasurable excitement underwent many transformations; but the method of expressing displeasure did not pass through so many changes. 3 The method of expressing pleasure became clearly defined with the dawning of intelligence, and its transitions corresponded to features of mental and bodily development. 4 A method of expressing displeasure without crying was developed, peculiarly rythmical (resembling in this respect the rocking to and fro of a person in agony), as compared with the jerky or explosive nature of the method by which the child gave vent to feelings of pleasurable excitement. The prominent part taken by the feet and legs whenever a strong emotion of either kind was finding expression is well worthy of note.

SECTION VI.—REFLEX MOVEMENTS.

Record.

First Day.—First cry. He 'nestled' close to a person who held him.

Third Day.—He started at loud noises.

Twentieth Day.—When water was squeezed from a sponge over his head and face, he closed his eyes and mouth, which he did not do at six months of age. (The practice of pouring water over the head having in the meantime been discontinued.)

Twenty-second Day.—Upon exposure of the face to the rays of a bright light during sleep, tighter closing of the eyelids was observed.

Forty-ninth Day.—He threw out the arms when lowered into a bassinet. This occurred earlier, and was, by its first observer, ascribed to an instinctive fear of falling. I failed to note exactly the date of its disappearance, though by the sixth month it no longer took place.

Twelfth Week.—Each time the train stopped, started or jolted during a journey lasting twenty-four hours, whether the child was waking or asleep, he threw out his arms as when lowered into a bed. While driving over a rough road he clutched the clothing of the person holding him when the wagon lurched.

Eighteenth Week.—He turned away the head from a strong light. This action he did not perform after the sixth month, and as late as the twenty-fourth month he was often puzzled as to which way to turn his head to avoid the direct rays of the sun. He raised the hands as if to ward off something, if touched during sleep.

Twenty-second Week.—He appeared as if frightened when the train passed under bridges, even very short ones; but the loud noise of passing trains failed to disturb him.

Twenty-fifth Week.—He clutched the arm and clothing of a person lifting him during sleep. (He had never fallen.)

Thirty-second Week.—When lifted up during sleep he drew his feet close to his body as if their soles had been tickled. General restlessness in illness, activity in health.

Interpretation.

For purposes of utility I have in this paper chosen a natural, rather than a philosophical definition of instinct. It is one which serves a two-fold purpose, designating a particular form of inherent activity and serving as a basis upon which to separate out allied forms which are called reflexes. Since my studies were in development and my records dealt in changes, I did not make reflexes the subject of a special investigation; but noted such as appeared from time to time during the early weeks of life. While the definition of instinct calls for an element of consciousness, it must not be supposed that any conclusive evidence is at hand showing such to be wanting in reflexes. So little of emotional expression was developed during the first few weeks of life, that it was difficult to decide whether the so-called reflexes were, or were not, accompanied by consciousness. I have, therefore, found the evidence of consciousness to lie, not in the action itself, but in the subsequent history of the act. If one of two acts performed at the same period should be repeated with little or no variation, only on the recurrence of the circumstances under which it was first performed; and if the other, continually changing and expanding, gave rise to new reactions in dissimilar circumstances, some justification may be found for ascribing an element of consciousness to the second which we withhold from the first.

SUMMARY.

The movements first selected for development were instinctive. Pleasure was not felt as such at birth. Feelings of discomfort were felt, but not distinguished one from another; they were strong. The first instinctive acts alleviated feelings of discomfort; and comfort (or satisfaction) was the result. Movements directed toward the attainment of comfort, replaced in a measure the mere expression of discomfort. Satisfaction or pleasure, as an end or goal, then emerged in consciousness; it corresponded to desire. After the growth of desires, development proceeded rapidly, in response to a demand for the satisfaction of them.

If we review the movements which have survived, we find them to have existed, (a) as instinctive movements alone; (b) as modifications of and additions to instinctive movements—direct accommodations to environment; (c) as instinctive plus spontaneous movements. No conclusive case is recorded of a spontaneous movement which alone has afforded a foundation for the development of further complex acts.

But the pleasurable feeling resulting from satisfaction is not enough to account for the reproduction of acts. It was necessary that an associative link should have been formed between a mental correlative of the act and the feeling, in order that a repetition of the act might be insured. Ample evidence is at hand of such links having been formed.

The development of the individual is thus seen to have depended upon three factors:

1. Upon inheritance as expressed (a) in instincts, (b) in the structure of the body, the relations of whose bony and muscular parts were such as to make possible only certain movements, and to exercise a control upon the range and direction of movements, (c) in the structure and functions of the nervous system, which rendered it capable of receiving forms of stimulation and responding to them, and which, moreover, was so constituted that paths once opened by stimulation and discharge, were thereby rendered the more pervious to the reiterated influences of like stimulations and discharges, and, (d) by the possession of consciousness.

2. Upon environment in a broad sense, comprising all things which might act as stimuli, from the food which the child took and the manner of taking it, to the objects which he handled and the persons who surrounded him; but especially upon those features of the environment which, by their persistence, acted as continued stimuli through whose instrumentality the fundamental movements of future activities became habitual.

3. Upon the plasticity of structures and functions.

PART II.—SENSATIONS.

SECTION I.—SIGHT.

Observations on the Development of Visual Perception.

First Day.—The eyes were opened by only a narrow crack. Sometimes they remained closed when the child was awake. The eye balls rolled constantly, whether the eyes were open or shut. Upon exposure to strong light the pupils underwent little alteration.

Second Day.—At twenty-nine hours the child looked intently at a bright light (of a lamp). At forty-four hours his eyes followed the movement of a pair of shining calipers, and he appeared to look, but without focusing the eyes, at his father who held them.

Third Day.—At seventy-five hours his eyes were wide open, and turned from one object to another. The eyes were not in focus. Convergence of the axes was marked.

Seventh Day.—Focus still imperfect. His eyes again followed a moving object. He looked successively at the faces of three persons who, standing in a row, bent over him.

Eighth Day.—He was seen to focus his eyes in looking at a hand. He looked fixedly at the hand when it was quiet, and followed it when moved.[1] He lay awake for half an hour looking at his surroundings.

Tenth Day.—His eyes were often in focus. His eyes followed the hand of a person beside whom he was lying, five times in its course back and forth across some sewing.

Twenty-sixth Day.—Attention and interest were excited by persons and light.

[1] Here unfortunately the notes have failed to record whether or not his eyes maintained their focus while following the hand, and the plane and direction in which the hand was moved.

Twenty-eight Day.—He turned his head (while lying down) in order to follow with his eyes the face of a person speaking to him.

Thirtieth Day.—At twilight he turned his eyes from a gas jet burning within a ground glass globe, to an adjacent twilight window, at which he looked fixedly.

Thirty-first Day.—His attention was engaged by a blue sacque (upon its first appearance), of a shade was similar to that of a blue piano scarf at which he had often looked.

Thirty-ninth Day.—As the child lay looking at the wall, which was illuminated by lamplight, his father's head was so interposed as to cut off his view. Thereupon he moved his eyes, and afterwards his head, in order to see again the wall behind the obstacle.

Forty-fourth Day.—Instead of dropping to sleep as he had previously done when taken for a walk, the child remained awake and interested himself in looking about.

Forty-seventh Week.—He watched the window as the light faded, keeping quiet and absorbed for half an hour. He continued to look with interest at the golden brown curtain which had held his gaze on the twentieth day. By this time he habitually kept awake when carried out of doors. He looked with interest at the beard of a male visitor.

Fifty-seventh Day.—He was amused by watching silent movements of the lips and tongue.

Fifty-ninth Day.—He was interested in looking out of the window at the trees, whose newly-opened leaves were constantly in gentle motion; also in watching an empty chair rocking before him, the separate movements of which his eyes did not follow.

Sixtieth Day.—He showed that he distinguished between a familiar and an unfamiliar face, by smiling at the former and regarding the latter seriously, with the pursed lips characteristic of attention.

Tenth Week.—The child at once noticed a stray lock of hair which was hanging at the side of his mother's face. When riding in the horse-car he tried to sit up and look around, and was annoyed by a shawl raised in front of his face to protect

him from wind and dust. While crying he was laid upon a sofa above which a gas jet was burning. The moment he saw the light his crying ceased, and his whole body began to move in excitement. Interest and excitement were maintained without interruption for half an hour. The light was then put out.

Eleventh Week.—The child looked repeatedly, and as if comparing them, from the face of one person to that of another. Upon a journey, the lights on the ceiling of the sleeping car gave him entertainment. During the day he lay on a pillow and looked continually at the figured linen on the back of the seat, or at the ceiling of the car.

Twelfth Week.—When hungry, the child cried if his mother appeared. Most of his waking moments were spent in his bassinet on a porch, watching the trees moving in the wind against the sky. Thus occupied he often lay for an hour, quiet except for the movements which accompanied deep interest.

Fifteenth Week.—The child observed his own reflection in a mirror. After the tenth week he had looked at the image of the face of the person holding him, never at the reflection of himself. Later in the fifteenth week he smiled at his own image.

Sixteenth Week.—He looked at his own pink dress and occasionally at some swinging balls. A red and yellow ball were offered him, he took the yellow one once, but could not be induced to reach again.[1]

Seventeenth Week.—The child was taken for a drive (in the country) during which he was so much interested that he became neither sleepy nor hungry. He directed his gaze continually to all quarters. He observed a white cotton string which was stretched above his bed and parallel with it, and from which his balls were suspended. He made many efforts to turn himself in order to follow its course above and behind him. He looked at trees, etc., outside of the window; but not at articles of furniture and movable objects within the room. He watched people. He recognized his mother as reflected in a mirror.

Nineteenth Week.—A box of blooming nasturtiums stood

[1] Thus did he baffle attempts at experiments.

within his field of vision. The child was never seen to give them more than a passing glance. One day a humming bird visited the flowers. He watched the bird with interest, and followed its flight with eyes and head. In the midst of a heavy shower the child watched a single stream of water which trickled from the roof and fell splashing upon the steps. He gazed out of the window, then turned his glance indoors, looking from one piece of furniture to another. After this he habitually regarded the furniture with interest. He began to notice flowers. He still enjoyed watching the fading light.

Twentieth Week.—Upon one occasion, in the eighteenth week, the child withdrew crying from contact with a person clad in black, who had also a loud voice. He afterwards saw persons so attired without evincing the least aversion to any one of them. A little kitten placed in his lap failed to elicit any response from him. He was interested in seeing his mother eat. He watched the cutting of the food and followed attentively the course of each bit from the plate to the mouth. Thus he was entertained during a meal.

Twenty-second Week.—When taken (in the city) for the first ride in his carriage, he looked at horses, carts and other passing objects, and at the parasol over his head.

Twenty-third Week.—After an absence of some twelve weeks the child was taken home. He at once observed the changed surroundings, and during the first day looked around the room continually. The golden brown curtain referred to above attracted the child's attention, and he watched it with as much interest as he had shown earlier. He laughed when he saw his mother don her hat. The association of the sight of the hat with going out was formed within ten days. In the country his mother had not worn her hat when out with the child.

Twenty-fourth Week.—Once again he would take no notice of a kitten. He did not notice, nor did he appear to see, a baby; but smiled at the woman who held her.

Twenty-seventh Week.—He observed a large picture of a boy on the wall of a strange house, and a landscape on the wall of his own room. He perceived a single human hair. He perceived people and wagons a block away, and watched their approach and disappearance.

Thirty-first Week.—He discovered the shadow of his carriage, and watched it for half a mile.

Thirty-third Week.—When riding in a horse-car, the straps swinging overhead interested the child. The other people in the car also interested him, and he observed the objects which they held in their hands. It became habitual with him to look after objects which had been dropped. He recognized an orange at a distance of several feet and in new surroundings.

Thirty-ninth Week.—A rubber cat and ball were given to the child. He took the ball and played with it; but the cat received no notice.

Fortieth Week.—He made fairly good estimations by the eye of size and distance.

Forty-third Week.—It gave the child delight to see a person leave the room and close the door, then suddenly open the door and reappear.

Forty-fourth Week.—He examined his nursing bottle with great interest.

Forty-fifth Week.—He distinguished between two bottles containing respectively milk and water, and chose the bottle of milk. He failed to follow the rapid movements of his father, who passed quickly in front of the child from one side to the other. Each time the child greeted his father in a new position with surprise, then looked to the one which he had just vacated. When his father ran quickly round and round the child, who sat upon the floor, he remained quite still, puzzled and unable to follow. When red and yellow balls were offered to him, he took the yellow 6 times out of 10; afterwards he would not reach for them.

Forty-ninth Week.—The child was greatly distressed to see a familiar object for the first time out of place. A clothes hamper, usually occupying a corner, was during his absence placed in the middle of the room. Upon his return he immediately perceived it and began to cry. His crying ceased when it had been returned to its proper position.

Fiftieth Week.—He stood before a mirror and made grimaces at his own reflection. He stopped the performance upon perceiving in the mirror that he was observed.

Fifty-first Week.—He observed another baby with interest.

Fifty-eighth Week.—He recognized a person whom he had seen but once, and for a few moments, three days before, but by whom he had been hurt. He was much interested in observing dogs, birds and a cow. He observed other children closely.

Sixty-fourth Week.—Caterpillars, bugs, beetles and worms became interesting to the child. He examined the feet and legs of some frogs.

Sixty-sixth Week.—He recognized the locality of the house in which he stayed, and of the laboratory in which his father worked.

Sixty-ninth Week.—Pictures, righted or reversed, interested him.

Seventy-sixth Week.—During a journey the child was entertained not only by what he saw within the car, but by looking out of the window and viewing the passing objects.

Seventy-seventh Week.—During three months the child had seldom looked in a mirror. When, at the end of this period, he was held before one, he at once recognized his own reflection as that of a baby.

Eighty-second Week.—He noticed the moon, and spontaneously called it a light.

Ninety-fourth Week.—He began to use the word 'big' in such a way as to reveal an appreciation of the size of objects seen.

One-hundredth Week.—He never evinced the least preference for colored over uncolored pictures. By this week he could distinguish the details of pictures whose area did not exceed 5/8 of an inch.

Vision.

In dividing my observations upon vision into three classes, I obtain series of facts from which to study some aspects of sensations in general, and from which to follow the course of the development of the ability to see.

Class I. includes all records relating to sensation proper; namely, those which reveal (a) the ability of the child to experi-

ence sensations of a given quality, and to react in a manner peculiar to them; and those which show (b) that it is possible to obtain through observation, data for the estimation of the intensities of sensations (or perceptions) relatively to one another.

Class II. includes observations pertaining to the muscular adjustments which were requisite to the accomplishment of clear vision.

Class III. contains observations illustrating the growth of the perception of things seen.

Sensations of light experienced during the first day were probably relatively insignificant; for very little light could have penetrated to the retina through the narrow chink of the nearly closed lids. The child was born at 3:20 P. M., on the 19th of March. He was therefore exposed to the light of day for but a brief time during the first sixteen hours. At night only a dim light was burned in the room. He slept during the greater part of the first 24 hours, and his eyes were often closed even when not asleep. Hence it was that the child, on the day following birth, was not continuously subjected to the influence of the rays of a bright light. At the beginning of the second day he opened his eyes more widely. At 29 hours he responded by a definite reaction to a retinal stimulus received from the full light of a Rochester lamp. The reaction consisted in resting the gaze upon the object of stimulation; it pointed to the occurrence of sensation, but gave no clue to its value in relation to the strength of the stimulus.

Simple as this reaction was, and inconclusive as it might be considered by one who had not closely observed the developing child, certain facts relating to the influence exerted upon attention by diverse objects at once help to place such a reaction in a position of importance, and give it the right to be considered a true concomitant of a sense impression of a definite kind.

Before going further in the subject of sensations I must digress slightly to explain what these facts were, and must ask the reader to bear them in mind as he proceeds. When the child was very young, only an extremely limited number of objects called forth reactions at all. This number increased with age and experience. It was possible to present to him one new

thing after another without eliciting the least perceptible response. Things were repeatedly shown to the child which, though in the immediate field of vision, he appeared not to see. Examples in the recorded observations which illustrate this are to be found in records for the 15th, 19th, 20th and 39th weeks.

In the history of individual development there may be found an unbroken chain of reactions which show more clearly than words can describe, just what the course of unfolding was. When a response followed the presentation of an object which might act as a stimulus, and was repeated with the recurring advent of the object, the response was to be regarded as a definite reaction, accompanying an impression made upon a sense organ which was in the proper condition for its reception. I would not be understood to claim that the objects which called forth no reaction aroused no sensation; but that those which called forth a reaction did cause a sensation, while others, such as objects seen in indirect vision, frequently failed to arouse that form of reaction which accompanied the stimulation of the sense organ.

In the study of sensation as such, I have ruled out, so far as possible, all cases in which the perceptive element was present. This was an extremely difficult matter to accomplish in dealing with records other than those of the earliest days. The early sensations may have been accompanied by the conscious recognition of the objects causing them; but it is in a high degree doubtful whether they were so accompanied. It is, however, certain that they were not attended by those groups of associations which soon began to gather round experiences. When a large surface, uniformly colored, engaged the attention of the child and held it for perhaps fifteen minutes, an example was given of stimulation and reaction which did not necessitate a perception of the colored surface, as distinguished from an illuminated one, nor did it inevitably involve any elements of association whatsoever.

In part I.[1] of this work it was pointed out that the child might experience sensations without distinguishing them one from another, and this fact must be again emphasized here.

[1] Movements, p. 14.

The study of the growth of the power to discriminate is closely associated with the development of the ability to perceive. That the child reacted in a peculiar manner to a certain form of stimulation is not a proof that he distinguished this from some other form, to which he had previously reacted in a different manner, or that the second stimulation and reaction called up the first. On the whole, I think we must admit that the first sensations at least approached somewhat closely to our notion of what extremely simple ones should be; to wit, feelings unattended by memory, anticipation or discrimination.

The order in which the child displayed the ability to experience qualities of visual sensation was as follows,

Light, undoubtedly the first retinal sensation, was experienced early in the second day. On the seventh day he gave evidence of having experienced sensations in indirect vision. On the fifteenth and twentieth days he possibly experienced color sensations, blue, golden-brown and red having been the colors which might have acted as stimuli (none pure tones of the colors, they represented). On the thirty-first day a white surface, receiving no direct illumination, acted as a stimulus, also a blue surface. On the thirty-fourth day a blue and white object and the golden-brown curtain arrested his attention. On the fifty-third day a plaid waist in which scarlet was the predominating color interested the child. In the sixteenth week he looked repeatedly at his pink dress. In the twenty-third week, after a long absence from home, the golden-brown curtain again attracted his attention. He did not give conclusive proof of the ability to recognize colors till the second year, when he showed that he recognized (without having received any instructions) the following colors: pink (eighty-fourth week), yellow (eighty-ninth week), black (ninety-fourth week), blue (ninety-seventh week), red (ninety-eighth week), light brown and gray (ninety-ninth week). Light always interested the child. After the thirtieth day he was pleased for some weeks to watch the window as daylight faded to darkness. On the thirty-sixth day, light reflected from eye-glasses called forth repeated expressions of pleasure. In the tenth week a burning gas jet proved deeply interesting, though the roaring and

flickering of the flame doubtless influenced him also. In the eighty-sixth week he used words to point out distinctions of light and darkness.

Before the tenth week the child gave no evidence of having received impressions from objects smaller than the features of the human face. In the tenth week he looked attentively at a stray lock of dark hair hanging beside a familiar face. Large objects and surfaces, moving or illuminated, attracted his gaze in the early weeks. In the seventeenth week a single strand of white cotton string such as comes from the grocer's, interested the child. In the twenty-third week he watched some flies on the window pane. In the forty-fourth week small objects, such as bread crumbs, became interesting to the child.

The simplest test of the strength of a sensation was that it should be followed by a motor reaction. In order to get some data for comparisons we have to inquire whether there existed any well marked differences in the motor reactions themselves from which something might be learned, as to the relative value of the sensations which they accompanied respectively. Such differences were clearly present. They were to be found in the varying force of reactions. Reactions of greater force were of two kinds; the first of which consisted of impulses, prolonged and involving a few muscles; the second, of impulses, diffuse and involving a great many muscles, notably those used in the expression of attention, and of the feelings of pleasure and pain. For example, when experiencing a sensation, the child sometimes remained quiet for half an hour, his gaze rivetted upon the object, or again, by a quivering of the whole body, flexions and extensions of the members, acceleration of respiration, etc., gave every evidence of excitement. It was not observed that attention accompanied by signs of excitement endured for a shorter time than attention accompanied by bodily quiet;[1] it cannot, therefore, be inferred that sensations accompanied by the expression of excitement were of greater intensity than those not so accompanied. That they might have been so, is not to be

[1] This is not to be taken to mean complete repose, which with the young infant was to be observed only during sleep.

denied. But it was clearly shown in the history of development, that the marked expressions of excitement did not accompany the early sensations, which were characterized rather by a quiet, prolonged interest in the object; while the later sensations, in the main associated with perceptions, had involved in their concomitant reactions, those movements which revealed the diffusion of the motor impulse. That it was possible for a sensation to be felt without calling forth a definite reaction was shown by the evidence of indirect vision. An object seen in indirect vision failed to attract attention, while an interesting object seen in direct vision was present; but, when for any reason, the object of direct vision failed to hold attention, the eyes were frequently turned to the second object in such a way as to show that this, as well as its predecessor, had made an impression. There were, therefore, three somewhat rough measures of the comparative intensities, of sensations, which were: first, of sufficient intensity to be felt without immediately causing a reaction; or, second, of sufficient intensity to be followed by a transient motor reaction; or, third, of sufficient intensity to be followed by a reaction which endured often as long as half an hour, which reaction consisted sometimes of those movements which were the peculiar attendants upon the stimulation of a given sense organ, plus the signs of attention, sometimes in the said movements, plus the signs of excitement.

The ability to see small objects depended upon the acquirement of the muscular adjustments essential to monocular and binocular vision, and is therefore related to the subject of eye movements.

The development of eye movements might well have been treated along with movements in general in Part I. The questions which there arise as to the original forms of other movements, and the methods by which variety and skill grew up, arise here. Was the first successful eye movement a chance coördination, or a reaction to a simultaneous stimulation of two organs of sight? It would seem that the movements of the eye muscles which pertain to vision, originated like other movements in some such primitive reaction or coördination as has elsewhere been called an instinct;[1] and that the subsequent coördinations

[1]Movements, p. 9.

neccessary to focus, fixation, etc., were built up upon this basis. That the history of the development of other movements has suggested this view to me I must frankly state. Nevertheless the careful consideration of the evolution of eye-movements would seem to point to it independently.

On the second day the eyes followed the movement of a pair of calipers—a shining object illuminated by daylight. Therefore following with both eyes preceded focusing and occurred immediately after the first determinate reaction to light stimulus. Following with the eyes would thus appear to belong among the inherent reactions as clearly as do clasping, sucking, etc. Amid the spontaneous eye-movement of the first few days such a reaction stood out very conspicuously. A great many movements besides those of the eye muscles are associated with vision. There are movements of the eyelids which allow of the entrance of light, and of the extension upwards of the field of vision, and all the accessory neck and trunk movements by which the eyes, along with the head, are carried into a better positions for seeing. None of these accessory movements (except that of opening the eyes) were observed during the first three weeks.

The eyes were not seen to be in focus before the eighth day. On that day the child focused his eyes upon a hand which was held above him at a distance greater than one foot, but not exceeding two. After the tenth day the eyes were frequently in focus.

Spontaneous eye movements occurred more rarely as time passed. By the eighteenth week spontaneous movements had ceased to be noticeable, and the eyes were usually in focus.

By the twenty-seventh week he had acquired so nice an adjustment that he was able to perceive a single human hair. Earlier than the thirty-seventh day little was recorded as to the accommodation of the eyes to near and distant vision. It was, however, certain that the child perceived objects at distances varying from six inches to ten feet after the tenth day. On the thirty-first day his gaze followed the departing figure of his mother across the room, a distance of ten feet, and the accommodation to the slow increase of distance was fairly good. By

the fifty-ninth day he could perceive from the second story window trees some fifteen feet away.

At twelve weeks he perceived moving objects at distances of 25 to 50 feet. In the twenty-seventh week he perceived objects in the street a block away and watched their approach. After the eighteenth week, when holding objects in his hands and looking at them, he usually held them at a distance for good vision.

In the second day, as has been said before, the eyes of the child followed the movement of an illuminated object. On the third day they again followed a moving object. On the seventh day they turned in succession towards each of a row of three objects, a phenomenon somewhat different from that of following movement, since it involved indirect vision, and movements made in response to sensations thus received. On and after the tenth day his gaze frequently followed a moving object. Active direction of the gaze towards an object of interest was not observed until the thirty-ninth day, and head as well as eye movements were involved in this direction. By the seventeenth week he was able to direct his gaze in all ways. In the tenth week he evinced a desire to sit up in order to see. In the seventeenth week he turned the body as well the head to extend the range of vision; in this week he held his head erect, turned it to the side, and raised his eyes to see the face of one who had spoken to him.

Previous to the nineteenth week he had followed only very slow movements; but in this week he made a distinct advance in being able to follow the flight of a humming bird as it passed from flower to flower, hovering for an instant at each. In the forty-fifth week he was utterly unable to follow rapid movements of a large body back and forth and round and round. Nor did he follow the course of a falling object, but discovered its position on the floor from the sound of the fall. In the sixty-sixth week, lying on his back, his eyes followed the flight of a fly which circled somewhat slowly above his bed. As late as the close of the second year he was rarely successful in perceiving the course of a projectile, (*i. e.*, a ball thrown by the hand).

He could perform more rapid movements of the body than

the eye could perceive when performed by objects or other persons.

The development of the perception of objects of vision is closely connected, on one side with an increasing sensibility to the influence of a greater variety of stimuli, and on the other with the development of the movements which pertain to vision. All study of sensations which extends beyond the territory of the first sense impressions, trespasses upon the confines of perception; and the consideration of the growth of the susceptibility to various qualities of sensation is so entangled with that of growth of the ability to perceive objects of sense, that it must be treated along with the discussion of the latter question.

I have explained above the manner in which the term sensation is used, and have pointed out that the child probably had but few pure sensations as compared with the number of perceptions, and that those nearest-to-pure sensations belonged to the early days. Nevertheless there must have been many occasions throughout infancy when a new experience, a new form of stimulus produced an effect closely allied in nature to those early sensations. There was, however, one significant difference which characterized the later sensations as partially perceptive—they were roughly classified and referred to their proper domain in the territory of sensation.

The confounding of sensations, (not the failure to localize them) which was conspicuous earlier in life, gave place to the ability to distinguish them one from another. New reactions arose, based upon differentiated sensations. These reactions showed the paths which the differentiation had pursued. The first perceptions were immediately the result of the first sensations and the reactions to them. The differentiation of sensation was accomplished by means of reactions, and it was not possible for perceptions to occur till sensations had undergone such differentiations.[1]

The term perception is here taken to mean the recognition of the presence of an object of sense. All objects possibly present to sense did not arouse reactions which showed them to have stimulated sensation, nor did all objects which stimulated

[1]For illustrations see Touch, below.

sensation, come to be immediately perceived. The requisites of perception were:

A. { 1. Sensation and 2. Reaction 3. A second sensation, or sensations, resulting from the reaction.

B. { The repetition of A a sufficient number of times to establish an associative connection of 1 and 2 with 3.

It will at once be seen, according to this view, that no perception could have occurred without a foundation in sensation and reaction; and that sensations and perceptions did not occur at haphazard upon the infant intelligence, an unassorted medley pouring in a steady volume upon it; but that the ability to receive and to perceive developed side by side along definite lines.

Visual preceptions, like muscular adjustments, were the result of the training received through experience. The early reactions were the instinctive movements which followed upon the stimulation of the retinae; but as seeing was replaced by looking, new reactions were manifested, and feature after feature of the surroundings grew through reiterated influence, to have some meaning for the child. The familiar, not the unfamiliar things then took on a deep interest for him. He watched them, and in following their changes, got perceptions of details, and of new objects in relation to the old. The history of perception tells of this steady advance, on the one hand, towards the perception of more in the familiar, on the other, towards the perception of change in the familiar.

To the twenty-eighth day the history consists in an enumeration of things which interested the child and engaged attention. On the twenty-eighth and thirty-first days in order to see more of an object, he put forth effort in the form of new adaptations of movement. After the thirty-first day there was steady progress in singling out features of the environment.

In the record several instances are noted of the failure of objects to elicit attention. The example of the cat was a good one. When a kitten was shown to the child in the twentieth

week he seemed not to see her. He had previously seen no small animals whatsoever. In the thirty-ninth week a rubber cat was given to him for a plaything, which proved equally uninteresting. During the following summer he handled animals of all sizes and often saw a cat and her family of kittens. The rubber cat in the meantime had been left at home. After his return it was immediately singled out as an object of special affection. It was given a name, 'lum,' by which all cats were then designated, and finally fell to pieces as a consequence of too much handling.

He perceived adults before he noticed children (whom he rarely saw closely during the first year), and was interested in pictures of persons for months before he cared for illustrations of other things. About the sixty-ninth week his interest in pictures increased greatly and he began to look at them himself. Naturally he got them inverted. The reversal never seemed to trouble him in the least, and until the ninety-third week, he continued to look at them either way with evident enjoyment. In the eighty-third week he was able to point out the details of familiar and unfamiliar pictures when looking at them inverted. It was not until the ninetieth week that he became interested in pictures representing a diversity of unfamiliar, as well as of familiar objects. From such examples as the above it may be gathered that much was to be learned from seemingly negative results as to the child's knowledge of things at a given period. In fact the record of what did not interest him taught almost as much as the record of what did.

The growth of the ideas of size, distance and direction, and his interpretations of pictures will be treated in Part III.

SECTION II.—HEARING.

Record of Observations.

Second Day.—The child ceased crying several times when his father began to whistle.

Fourth Day.—He frequently looked at his father when spoken to by him.

Seventh Day.—He looked intently into the face of a person who spoke to him.

Seventeenth Day.—During this day he was peculiarly sensitive to sound.

Twentieth Day.—He lay still for fifteen minutes while someone was singing to him.

Twenty-fourth Day.—The effect of the striking of the clock was observed. Twice he stopped crying while it struck, and once he was aroused from a light sleep by its gong.

Thirtieth Day.—Undoubtedly he turned his head in the direction whence sounds proceeded.

Forty-sixth Day.—To talking and singing he replied by cooing. At this time and later the effects were observed of noises from within and from without the room. Those from within frequently, though not always, disturbed him; those from without, though often loud, rarely aroused him.

Seventeenth Week.—He evinced pleasure in an action song, looking from the hands to the face of the singer.

Eighteenth Week.—Hearing the rain falling, he turned his head towards the open window and lay quiet listening. S and sh sounds had a soothing effect.

Twentieth Week.—The slightest sound served to interrupt his meal, and he looked in the direction whence it came.

Twenty-second Week.—In the beginning of a journey the child was continually startled by the shrill whistles of the trains; but after twelve hours they ceased to annoy him, and he even became oblivious of the loud noise of passing trains. Sounds in his sleeping room not loud enough to waken him, were followed by such movements as rolling the head, lifting the hands feet and legs, and by inarticulate murmurs. He took pleasure in a noise made by himself, but rendered articulate by the hand of another patting his mouth.

Twenty-sixth Week.—Noises which startled him when awake no longer caused crying, but the child displayed great curiosity as to their source.

Twenty-seventh Week.—Localization of sounds, with the exception of those from behind the head, was fairly well established.

Twenty-eighth Week.—He recognized the tune of the action song which had first given him pleasure in the seventeenth week.

Thirty-second Week.—His father's imitations of the voices of animals entertained the child and made him laugh.

Thirty-third Week.—The ringing of the door bell in a room caused great astonishment.

Thirty-eighth Week.—He drummed continually with some hard object upon the table of his high chair.

Forty-first Week.—He began to distinguish among spoken words. He enjoyed screaming, making each successive scream louder than the last, till he jumped with the effort.

Forty-third Week.—The sound of a blow upon the sterilizer frightened the child; but after he had been shown the sterilizer, inside and out, he no longer objected to the noise.

Forty-eighth Week.—He recognized a second tune, belonging to an action song.

Fifty-second Week.—Any noise coming from the direction of the stairs, he associated with the coming of his father.

Fifty-fifth Week.—He understood a little language and possessed some words of his own.

Seventieth Week.—Words which he merely imitated, and which had no meaning for him, he did not afterwards repeat.

Seventy-second Week.—He struck a bell jar with a glass stopper. The sound which resulted caused him to start with surprise. He turned to a scrap basket and struck that with the stopper once, then returned to the bell jar and made it ring repeatedly.

Seventy-fourth Week.—He heard the tolling of the buoy bell 2½ miles out to sea, and said 'g'ling, g'ling,' a word used to indicate a bell.

Seventy-seven Week.—He called out 'baby' when one cried in another state-room.

Ninety-third Week.—He sometimes confused words which sounded alike if they were used together.

Ninety-seventh Week.—When singing he made a somewhat doleful noise, lacking the least semblance of a tune. At this time he easily recognized five tunes, and if they were hummed for him, was able to supply words at the right notes.

One-hundredth and fourth Week.—One day the oven door was slammed when the child was sitting in the kitchen. He began to cry, and putting his hands upon the epigastric region of his body said that he was hurt.

Hearing.

The first definite reactions to auditory sensations were observed on the second day, during which the child several times stopped crying when his father began to whistle. If a loud noise accompanied by a perceptible jar had thus affected the child, the reaction might have been attributed to the influence of the vibration upon the body, as well as to the sensation of sound. Such a noise as whistling, however, could scarcely induce a general bodily sensation, so the reactions must have occurred in consequence of auditory sensations experienced by the child on the second day.

Auditory sensations, unlike others, so far as could be ascertained, depended directly upon the physical condition of the child, who unquestionably had times of extreme sensibility to the impressions of sound. An apparent insensibility to noises was characteristic of the first month of infancy. During this period the child would sleep undisturbed in the family living room, while persons were conversing and moving about. And it was by variations in this apparent insensibility that much was learned concerning his ability to hear. On the third day loud noises, such as the slamming of a door, caused the child to start, or to cease crying; but the common sounds of the room called forth no reaction. On the fourth day he showed that he heard the human voice. On the seventeenth day the child was restless, and, owing to a slight indisposition, unlike his usual self. During the day he did not sleep well, and such noises as a footfall or a voice within the room aroused him. On the three succeeding days he was once more quiet and oblivious of sounds; but on the twenty-first day, after an attack of colic, the child was peculiarly sensitive to sounds, so that he could get but little sleep. Sudden noises, whether loud or low, were especially disturbing to him. On the twenty-second day he returned to a condition of normal indifference. It was, however,

noteworthy that a slow but steady increase of irritability was taking place, which ultimately landed him in a condition of normal irritability, very similar to the abnormal one which had accompanied the early indispositions. In the sixteenth week, the child being to all appearances in perfect health, the least noise in his sleeping room (such as the rustling of a pillow case) aroused him from his nap. This was not true of his night sleep, which was probably heavier.

The increase of sensibility to the influence of sound was shown in another way; namely, by the effect of noises upon the child while eating. In the early weeks the child devoted himself to the task of satisfying his hunger regardless of what went on about him. He had to learn to accommodate himself to his supply of nutriment as well as to other features of his surroundings, and no doubt found the task of suckling thoroughly engrossing in its pre-automatic stages. It is therefore not surprising that noises, if he heard them while feeding, failed to attract his attention. In the sixteenth week sounds began to prove a real source of distraction, causing him to pause and to look around many times during his meal.

The possibility of becoming accustomed to the influence of noises was noticeable also. From birth the child was used to the noises of the street, which rarely disturbed him. In the eleventh week he was taken to the country where, during eleven weeks he heard no noises similar to those of the city. In the twenty-second week he returned to town, and when laid down to sleep in a room which was not directly on the street, it was quite impossible for him to rest. Although he was tired and many times composed himself to sleep, some passing vehicle invariably aroused him. At the end of two days he had become somewhat accustomed to the noises of the street, and by the tenth day they no longer exerted a disturbing influence. In the twenty-third week hammering in the next room did not arouse him.

The acquirement of an insensibility to certain classes of sounds would seem to have been as important in development as the increase of sensibility. There was not, however, a history of growing indifference to the influence of all sounds. The

striking of the clock, a sound which arrested the child's attention on the twenty-fourth day, interested him repeatedly during that part of the two years which he spent at home, and long after all ordinary noises of the street had ceased to be remarked, he would pause to listen to the striking of the clock.

It has already been stated that sudden noises often startled the child and caused him to cry violently. This was especially true of noises which disturbed him while sleeping or eating. The effect produced by sounds at such times seemed to depend, not so much upon quality and pitch, as upon abruptness. Even a low voice addressing the child when he was attentively looking at something, often caused him to start violently.

After the ninety-fourth week he evidently appreciated the rhythm of poetry, for he greatly liked to hear the Mother Goose melodies. Dr. Bolton's studies on rhythm[1] suggested to me the advisability of ascertaining whether any particular rhymes were more agreeable to the child than others. I began by repeating 'Baby Bye, here's a Fly,' etc. At first he did not like it, and once he cried when, thinking to please him, I began to say it. This was in the eighty-eighth week. Some days later he, of his own accord, asked for the rhyme which he had not in the meantime heard. Once in the ninety-fourth week I heard him repeating it to himself. He had the rhythm correct, but not all of the words. Nonsense syllables took the places of the words omitted. He would not at any time listen to poetry which contained no familiar words. After a few stanzas his interest flagged, and if the poetry continued he became impatient, and ordered it to be stopped. On the other hand, he often sat quietly listening to some simple rhyme or poem whose repetition he demanded from five to fifteen successive times. He had some favorites among the rhymes and jingles, but I could not discover that his choice of them as such depended upon a peculiarity of the rhythm.

If he had an appreciation of melody he never showed it. He learned to recognize tunes without the words of the songs which they accompanied; but he did not care for songs containing no familiar words, and in the ninety-eighth week he cared most for those of which he could understand the most.

[1] *American Journal of Psychology*, Vol. VI., No. 2.

No reactions whatsoever pointed to an inborn ability to localize sounds, and to judge of the distances they traversed. Simply to look at an object from which a sound issued was the first step towards localization. This the child did on the fourth day, in looking at a person speaking to him. As the localization of sound was not established till somewhat after the child had formed the habit of turning the eyes and head in order to see, a connection in development may have existed between the two acquirements. It is certain that the eyes had many times followed noiseless movement, and movement accompanied by sound, before the accurate localization of the direction of sound was established. On the twentieth day the child turned his eyes twice to look into the face of a person who spoke to him. On the thirtieth day he began to turn his head in the direction whence sounds proceeded. By the eighteenth week he could locate very well sounds coming from objects within the visual field. In the twenty-sixth week he seldom cried at sounds which startled him; but was curious as to their source. In the twenty-seventh week, when he could sit, it was found that he could not localize sounds which came from behind him, but looked for their sources in front. This was true especially of sounds made near the middle of the back of the head. In the thirtieth week he for the first time drummed on the upright piano, and was surprised that the noise issued from the piano case instead of from beneath his hands. He looked up at the piano and down at his hands repeatedly.

Some experiments in playing 'hide and seek' made in the forty-eighth week showed how well the ability to judge of the direction whence sounds proceeded was established. Some one hid while the child was out of the room. When he crept in she made some low noise to serve him as a guide. The experiment was repeated a number of times, but he invariably found her without a mistake, wherever she was concealed. When the voice came from the closet he seemed puzzled for a moment, and paused to look about before starting and on his way towards the door. Nevertheless, he went without deviation to the right place.

He had no perception of the distance traversed by the sound

in reaching him. In the eighteenth week this was well shown in an experiment with an organ. The child lay in his bassinet eight or ten feet away from the organ. A person sat on a chair between him and the organ, yet not obstructing his view. Upon hearing the tones of the organ he looked in surprise at the person in the chair, accepting the noise as from her. When taken on the lap of the person playing he looked at the organ in astonishment.

In the fifty-fourth week in calling to a dog at some distance he scarcely raised his voice above a whisper. He was over two years of age before he recognized the fact that people at a distance could not hear him unless he raised his voice. It was quite certain that ideas of distance and pitch were not generally associated with sounds before the close of the second year.[1]

Probably the first sound recognized by the child—the first one assimilated with past experiences of a like nature—was that of the human voice. By the nineteenth day the sound of the voice was distinctly associated with pleasant experiences, so that he smiled when addressed.

On the forty-sixth day he began to respond to sound by sound, crowing when someone talked to him.

Recognition, in the case of the young infant, did not necessarily involve discrimination, but was rather a preliminary to discrimination. It did not depend upon diversity of experiences, but upon repetition of them. The bases of the first recognitions of sounds were to be found in some elements of experience other than sound itself. This was clearly shown in the case of footsteps. After the eighteenth week, if the child wakened crying, footsteps on the stairs at once quieted him, for these he had learned to associate with the relief which followed the appearance of his mother. In the seventeenth week he was interested in one of the kindergarten action songs, and looked repeatedly from the face to the moving fingers of the singer. In the twenty-eighth week, having heard this song frequently, he recognized the tune alone, and amidst a medley of other tunes. From the twenty-second to the twenty-seventh weeks

[1] Nor have such ideas become elements in the perception of sounds at 2 yrs., 7 mo.

the child might have heard trains passing at almost any moment of the day, yet the noise of the shrill whistle was the only sound of the trains to which he responded. In the twenty-seventh week he was taken on a journey, during which he was interested in the passing trains. A few moments after his return a train passed along the neighboring tracks. He heard this at once and looked about for it. Such cases might be multiplied almost indefinitely; but those cited illustrate sufficiently the statement made above.

The sounds first recognized were those which had been heard by the child many times. Later his memory for sounds developed, and he often recognized those which were comparatively new.

He became familiar with a wide range of sounds, and could, after the ninety-eighth week, refer each instantaneously and correctly to its source. All the noises of the house, whether loud or low—footsteps, coughing, rustling garments, objects falling, fire crackling, kettle boiling, etc., etc.—were remarked upon by him; and each experience seemed to have for him its auditory accompaniment. The sounds of nature also interested him greatly, from the noises of insects, birds and beasts, to the whistling of the wind, and so forth.

When his memory for sounds, was once established, the child often alluded to a sound if the circumstances upon which the recognition was based occurred without it. In the forty-third week he gave some evidence of an ability to recognize a sound absolutely. One day his mother snapped her fingers. He listened attentively to the noise produced thereby. Then he clicked with his tongue against the hard palate, and the result was a sound almost exactly like the one produced by the fingers.

It must not be supposed that the child could discriminate nicely when able to recognize so many sounds. On the contrary, he was easily thrown into confusion if similar sounds, which he was able to recognize singly, were used together. This was true especially of words sounding alike. The development of the ability to discriminate was noticeable during the acquirement of language. As a first step towards discrimination there was babbling—a separation of the sounds of the voice from

other sounds. Then a few sylables were distinguished. Words often appeared in babbling before the child could use any words intelligently, which showed that certain combinations of sounds had been singled out for reproduction from the many which greeted his ear. Frequent repetition of such syllables occurred about the forty-second week. Many of these were parts of words from the conversation of his elders which did not relate personally to the child.

It was not uncommon, especially when he first began to speak, for him to confuse words sounding somewhat alike. This I have spoken of under Language and have there shown how it affected the acquirement of the correct pronunciation. If, however, he knew what the pronunciation should be, yet failed to achieve it, he was quick to detect the mistake and always paused to correct himself. The perception of differences in spoken words no doubt depended somewhat upon the movements and positions taken by the mouth-parts in framing the sounds; he was, however, often able in the second year to detect by the ear alone individual differences in the pronunciation of other persons.

Regarding his interpretation of sounds, enough has been said in the discussion of recognition to show that well nigh all the sounds perceived came to be so associated with experiences involving other than auditory sensations, that the instantaneous reference of a sound heard to one of these experiences was inevitable. All early meanings attached to sounds were naturally of a personal nature, and the first sounds interpreted were those associated with the comfort or discomfort of the child himself.

When his intelligence had moved beyond the stage of purely personal reference, and he had begun to be interested in things for themselves, a new and wider circle of interpretations was formed (close of the first year). Then it was that the child, while rightly recognizing sounds, fell into errors of interpretation. Such errors became more numerous with the passage of time. His accurate memory for past experiences led him constantly to reconstruct upon the basis of a single element, and to demand repetition when there was no liklihood of its occurrence. One example will illustrate. In the sixty-eighth week a little boy in

the neighborhood used a tin horn to celebrate the Fourth of July. The sounds of the horn came to us from across the road at frequent intervals for a week, and the baby often looked from the window at the little boy, who went away at the end of the week. Three weeks later a tradesman announced himself by means of a similar horn. The child who was playing on the floor, looked towards the window and called his little playmate.

It was pointed out in the part of this work devoted to Vision that the observer had some means of judging of the relative intensities of sensations. It was possible to learn more of the intensities of visual than of auditory impressions. The reason for this is obvious. The vast majority of auditory sensations of the little child did not stand alone, but were associated with objects perceived at the same time through the medium of another sense or senses. It was not for themselves that the interest of the child was excited; but rather in their relation to objects did they have a value for him. It was therefore difficult to isolate in one of these complex experiences his reaction to the auditory element alone. It often happened that he seemed not to hear a sound which he afterwards recognized unfalteringly. Hence the effect upon him of one sound after another was not so readily to be noted as the effect of one visual sensation after another; and it was far less apparent to the observer that they did influence him in such varying degrees.

The notes record but few instances of sounds which, unaccompanied by other stimuli, engaged and held attention, in proportion to the number of such examples relating to vision; and they give but comparatively few cases in which sounds induced the reactions attendant upon excitement. But the early auditory sensations were often the means by which intensely unpleasant feelings were produced. There is certainly no example recorded in which a purely visual sensation was unpleasant enough to cause crying. Even the direct rays of the sun upon the eye did not do that; and the necessity of focusing the eyes upon the object, together with various protective adjustments, of iris, lids, etc., excluded the possibility of shock, from which the discomforts of hearing resulted.

On the nineteenth day he began to smile when spoken to,

and the sound of the voice in singing and speaking afforded him pleasure. In the eighteenth week the tones of the parlor organ, and the whistling of the wind induced pleasurable excitement. In the thirteenth week he evidently derived pleasure from noises made by his own voice. In the thirty-eighth week and later, noises made by himself in hammering and screaming, however discordant and loud, did not annoy him. These noises were tolerated or enjoyed, not only because they were associated with his own activity, for it was clearly shown in other cases, that such loud discordant sounds did not affect him unpleasantly. One day towards the close of the second year he went under a bridge over which a heavy freight train was passing with tremendous clatter and vibration. It did not seem to affect the child unpleasantly. On the ensuing day, as he passed beneath the same bridge, he bewailed the absence of the train. In the fifty-first week he began to cry when for the first time he heard muslin torn, but laughed when the noise was repeated. Something has been written above of his susceptibility to the qualities of auditory sensation. It remains for me to record the influence upon him of a few sounds of fixed quality. On the twenty-fourth day the striking of the clock began to affect him. On the same day, when someone chirped to him, he started violently. On the forty-sixth day the sound of rattling spoons interested him. It was observed from the sixty-first day that the voice of his father had a more subduing effect than the voice of his mother. In the fifty-ninth week the music of a street band of wind instruments afforded him evident enjoyment. The ear of the child would appear to have been sensitive to a wide range of auditory sensations; but the principle which governed the increase of the range of sensibility to visual sensations, was active in extending the range of sensibility to auditory; namely, the development of perceptions which took place as a consequence of the direction of attention to sounds. The stages of the development of hearing may be described briefly as follows:

1. Sensation.
2. Recognition and distinction.
3. Discrimination.

Interpretations occurred along with recognitions and discriminations.

SECTION III.—TOUCH.

If in the foregoing discussions of sensations I have made one generalization clear, it is now understood that any sensation which had an observable effect upon the child was followed by some form of motor reaction. It has also been shown that the forms which should be assumed by reactions differed in quality according to the sense stimulated. The reactions which were associated with sensations of the skin consisted of movements of the body as a whole, or of its members, and in the most primitive stage of reactions these were further the movements of the parts which lay near, or were closely connected with the portion of the surface stimulated; such, for example, as a twitching of the muscle beneath an area of skin subjected to tickling (nineteenth week), and licking in response to the feeling of milk flowing over the lips (third day). Some touch movements belonged to the class earlier described as instinctive, others to that of reflexes. By means of such reactions one of two possible ends was accomplished, either the body (or some portion thereof) was withdrawn from an unpleasant contact, or it was brought into closer union with a pleasant one. When voluntary movements had become possible the members could be brought into contacts not actually present to the skin, but thought of, or suggested by some one of the train of circumstances in which the contact was first felt as agreeable. There were then two distinct forms of action which figured as reactions to sensations of contact; namely, the inherent and the voluntary. Reactions of the first kind, by inducing changes in consciousness, made the child aware of those gross areas of his body which responded in a fixed way to definite qualities and quantities of stimulation. If we bear in mind the great number of inherent reactions, their distribution to nearly all parts of the body, and that each was called forth by the stimulation of a definite portion of the skin, and, except in rare cases, by the stimulation of no other area, the method by which the child came to

TABLE I.—TOUCH RECORDS.

DATE.	CONTACT.	TEMPERATURE.	PAIN.	LOCALIZATION.
Day. 1st	He ceased crying a number of times when a hand was laid upon his body.			
2d	He felt the touches of calipers upon his head.	. . . . .	. . . . .	The touches of the calipers upon the head were responded to by attempts to withdraw the head.
4th	He felt the touch of a finger upon the cheek. Full immersion in a warm bath was agreeable to him, and when water from a sponge trickled over his head and face he seemed to like it.	. . . . .	. . . . .	He turned his head toward the cheek touched.
6th	. . . . .	To be soiled or wet at once caused the child to cry.	. . . . .	He pressed his hands against his mother's breast while suckling—the beginning of localizing sensations of touch in the palmar surface of the hand.
17th	. . . . .	. . . . .	An irritation of the skin caused restlessness and irritability.	
20th	. . . . .	. . . . .	. . . . .	When water was poured over his head he closed his eyes and mouth.
36th	. . . . .	. . . . .	. . . . .	When his mother washed out his mouth he put his hands up to hers.
38th	. . . . .	. . . . .	. . . . .	He grasped his mother's forefinger and carried it towards his mouth.

TABLE I.—TOUCH RECORDS. *Continued.*

DATE.	CONTACT.	TEMPERATURE.	PAIN.	LOCALIZATION.
Day.				
39th	. . . . .	. . . . .	. . . . .	He objected to having his hands covered.
Week.				
11th	Active feeling of what came to his hands. He perceived the difference between flannel and muslin.	. . . . .	An arm, very sore because of vaccination, seemed to cause him little or no discomfort.	He began to finger and to feel objects.
12th	Gentle rubbing of the head caused the child to stop crying.			
14th	He began to feel his own body when undressed.	. . . . .	. . . . .	He began to feel of the various regions of his own body when undressed.
16th	. . . . .	. . . . .	He struck his head hard against the chin of another person; he looked surprised and then began to cry.	He began to play with his own fingers.
18th	He liked to have his body and limbs rubbed.	. . . . .	When scratched in the leg by a pin, he cried.	
20th	He sometimes used the feet to feel with.	. . . . .	. . . . .	He sometimes used the feet to feel with.
22d	. . . . .	. . . . .	. . . . .	He rubbed his eyes when soap suds accidentally got into them.
24th	. . . . .	. . . . .	For two days he frequently struck himself forcibly on the mouth and face, but he seemed to feel no pain.	Covering on the feet became distasteful to him.
26th	. . . . .	. . . . .	. . . . .	He located tickling on the ear, which organ he scratched.

TABLE I.—TOUCH RECORDS. *Continued.*

DATE.	CONTACT.	TEMPERATURE.	PAIN.	LOCALIZATION.
Week. 27th	Active touching with hands, feet and lips. Flies wakened him if they walked on his face.	. . . . .	. . . . .	He felt objects with hands and feet, and then put them to his mouth.
30th	. . . . .	. . . . .	. . . . .	He localized quite accurately the touch of a finger tip upon various parts of the head, evincing his ability to do the same by reaching after and grasping the finger.
35th	A blanket, laid over the child during his sleep and nowhere touching the skin, was often the means of waking him; as it disturbed him before he had had time to feel a change of temperature, he must have felt the pressure.			
33d to 46th	After the 33d week touch was cultivated by handling a variety of simple objects—balls, clothespins, spoons, celluloid and rubber "gum-rings," a palm-leaf fan, paper, cubical blocks, boxes, a little doll, a string of buttons, books, bread, etc., each of which he felt of and looked at.			

TABLE I.—TOUCH RECORDS. *Concluded.*

DATE.	CONTACT.	TEMPERATURE.	PAIN.	LOCALIZATION.
Week. 38th	Solid food in the mouth was objectionable to him.			
39th	. . . . .	. . . . .	. . . . .	The forefinger tip used to feel small objects.
46th	In trying to hold three unlike things in one hand, one always slipped away, yet he did not miss it till he had looked in his hand.			
52d	. . . . .	. . . . .	. . . . .	He localized pain well, putting his hand on the hurt.
69th	He walked into the water, but drew back half frightened when the wavelets washed against his legs.	He seemed oblivious to the difference of temperature between the sand and water of the shore of Vineyard Sound.		
101st	. . . . .	In this week he began to use 'too hot' to designate what was either hot or cold.	. . . . .	Internal pain he localized on the surface of the body near the organ affected. During the latter half of the second year he was interested to learn the names of the parts of his body. It was easy for him to separate the various members and features, but not to make distinctions which rest upon internal divisions, such as the abdomen, thorax, etc.

know those areas of his body which were, so to say, mapped out by sensations and movements, becomes clear to us. But from the repetition of the inherent reactions he could learn nothing further than this. In the attempt, however, to reproduce the movement and to regain a contact, there entered the element through whose agency the adjustments and distinctions were developed which were essential to progress.

There are three ways in which the reproduced movements affected development:

1st. By recurring at the suggestion of similar and practically identical circumstances they brought about a result practically identical with the original one. Older experiences were thus defined and older impressions renewed and intensified.

2nd. By recurring at the suggestion of similar, but not identical circumstances they produced a result which varied somewhat from the original one, and in which new sensations of contact were given and new adjustments obtained.

3rd. By recurring at the suggestion of similar circumstances they produced a result entirely unlike the original one, in which material for contrast was furnished. In early infancy, the child could not use such material, hence totally dissimilar experiences entered but little into the woof of the mental fabric during some six months.

The reactions which have been described as instinctive actions and reflexes[1] showed that localization of sensation to certain areas of the skin existed soon after birth. This localization must not be mistaken for a conscious appreciation of the parts stimulated. The fact that the child was able to remember and to reproduce an action upon the recurrence of the conditions which had first induced it, showed that a sensation had been consciously felt. There was, however, absolutely no evidence of the ability to locate such a sensation in a part of the body which he recognized; but the evidence showed sensations in general to be experienced and confused. The slow and laborious process was apparent by which the mental separation and differentiation of the bodily parts and surfaces were developed. The steps by which one portion after

[1] Part I, Movements.

another of the surfaces of the members was separated from its surroundings, and used through the agency of movement to obtain sensations, were recorded and have been spoken of under Movements.[1]

Therefore, whether we agree with those writers who claim that the so-called local signs depend upon some quality of the end organs themselves, or with those who believe them to be associated movement elements, or with those who find in the varying thicknesses of epithelial layers, or in muscle tensions, or in the number of end organs excited, sufficient explanation of their existence, it must be admitted in the present case, that they were not inherent or primitive; and that they were mental, the results of syntheses of sensations; and that the sensations out of which these syntheses were constructed were primarily of two kinds, pressure and movement. It is a question whether movement sensations alone were sufficient to give a local coloring to dermal sensations. Considering only the sensations of the skin proper, it must be admitted that the movement element was the one *essential* to the development of localization. It may, however, be argued, that if the slow differentiation and mental gaining of part by part were pursued as described above, years instead of weeks would have been required in development. But it was the first steps, and the first syntheses which required time for their completion, and it may be laid down as a law, that neither the time nor the experience was necessary for a succeeding related synthesis which had been required in obtaining the elements out of which its predecessor had been constructed.[2]

Pressure caused by a hand resting upon his body was soothing to the child from birth. The gentle patting of the back had a soothing effect also. He was at first the passive recipient of pressure stimuli. By the sixth day his open hands often rested upon surfaces of various kinds, and thereafter he slowly acquired the habit of feeling objects—or, rather be it said, the surfaces of

[1] Movements, pp. 21–23.

[2] For illustration consult Hand and Arm Movements, comparing the acquirements of the first twenty-seven weeks with those of the nineteen weeks following; also Observations on the Development of Visual Perceptions of the first sixty days with the period included by the nineteenth and twenty-seventh weeks.

objects—till by the time grasping was possible to him (twelfth week), he had experienced many touch-sensations.

Sensations of touch were obtained not only from the surfaces of the hands, but from the lips, tongue, soles of the feet and toes. Indeed the lips and the tongue were the first organs of active touch, the hands were next used, and lastly the feet. In the twenty-seventh week he used all three sets of organs, grasping an object in the hands, feeling it with the soles and toes, then putting it up to his mouth. Long after he had ceased to use his feet for touch, the lips still supplemented the hand.

It may be stated in a general way that his sensibility to impressions of contact increased with the development of active touch. Prior to the sixteenth week he was content to suck his own thumb when hungry, the feeling of milk in the mouth was, therefore, not an essential element in the feeding-complex. But in the thirty-eighth week it undoubtedly was; for he then at once spat out the thickened cream of sterilized milk.

In the twenty-ninth week he perceived the presence of salt or sugar in the mouth, acting as one does who finds his mouth filled with sand. His first objections to solid food were evidently founded upon the novel touch sensations which it aroused in the mouth.

In the eleventh week the hands distinguished between flannel and muslin.

In the fourteenth week, when rubbing his hands over a face, he encountered a handful of hair, and was surprised thereby.

After this the sensations of the skin of the hands became so closely associated with movements that, having made no experiments upon skin sensation only, I cannot separate the development of the one from that of the other.

In the nineteenth week flies walking on the face of the child caused his muscles to twitch; but when on the hands they seemed not to annoy him.

In the twenty-seventh week flies on his face became unpleasant to him, and caused him to waken if they crawled upon him during sleep. Beyond this I do not know whether he was sensitive to tickling or not.

From birth he objected to a wet or soiled diaper. It seems probable, since a bath of proper temperature was agreeable to him, that the warmth suddenly suffused over a considerable area of the skin was the cause of his displeasure. About the thirty-ninth day it was observed that he frequently cried when returned to the bassinet at night after having been taken out to receive the necessary attentions. If a hot water bag was laid in the child's place during his absence, and he was then laid upon the spot so warmed, he never cried, but at once went to sleep. The temperature of the sleeping room did not not at this time fall below 66°F.

In the sixty-sixth week he frequently stepped barefooted from the warm sand of the beach to the cool water of Vineyard Sound, without seeming to notice a difference in temperature. In the eighty-second week he liked to hold his head under the spigot, and it was apparently a matter of indifference to him whether warm or cold water flowed therefrom over his head and face. He liked to be washed in cold water less than in warm.

In the one-hundredth week he objected to the introduction into his arm pit of the bulb of a thermometer. This objection may not have been based entirely upon the temperature of the bulb.

In the early weeks the child gave no evidence of an ability to localize pain. Indeed, he did not localize pain till he was able to localize other dermal sensations. This was in part due to the imperfect use of his hands, for he could not have been expected to place the hand upon an injured part before he was able to place it voluntarily upon an object.

This peculiarity of the growth of the ability to localize sensations of pain would seem to be accounted for by the explanation which considers the localization of pain to be dependent upon the localization of touch sensations, and the result of the association of sensations of pain with those of contact. A further proof of the correctness of such a view was found in the manner of localizing internal sensations of pain, which he referred to some portion of the surface of the body near the internal part from which the disturbance originated. Distress in

the throat he localized on the neck, and pain in the bowels in the naval.

By the fifty-second week he was able to locate pain on the surface of his body with considerable accuracy. During the first year he displayed the comparative insensibility to pain which is said to be characteristic of early childhood. On the twenty-first day he suffered not a little from an attack of colic. In the eleventh week, however, he had as the result of vaccination, a very sore arm, which seemed to give him little or no discomfort. He often knocked his head against that of a person holding him with force enough to hurt the adult, yet he apparently felt no pain. In the sixteenth week he struck his nose in this manner, and surprise at the result was after an interval succeeded by crying. During the fifth and sixth months he kicked the bassinet repeatedly with force enough to hurt the soles of bare feet, yet it was doubtful whether he was ever hurt.

In the twenty-ninth week, when trying to get on his hands and knees he bumped his head and nose severely; but this did not deter him from persisting in his efforts to creep. Nor did hurts long cause discomfort, even though the bruises and cuts in which they originated remained. Upon several occasions during the second year the child fell while running and cut his upper lip badly, so that it bled profusely, and afterwards swelled and looked extremely sore, yet after the first outcry he never referred to it. Quick sharp blows, cuts, and the one insignificant burn which he received did hurt him. In the eighteenth week he cried long and loud when scratched on the leg by a pin point. About the thirty-fourth week he sometimes scratched his scalp with his own finger nails, breaking the skin, which caused him to cry.

It was always possible to destroy the effect of an ordinary bruise by distracting his attention from it; and later by suggestion. To have the hurt kissed was more efficacious as a cure than to have some medicinal remedy applied.

It was a difficult matter to judge of the comparative intensities of sensations of touch. The occurrence of movements along with contact presented a difficulty which it was hard to get over without assistance from experiment. Then too the em-

ployment of sight in addition to touch began to add complications at an early date.

The recognition of sensations of touch was not as a rule based upon the association of touch with touch sensations; but upon the association of touch with movement or vision. The eye saw many objects in proportion to a few felt by the hand.

The eye might rest upon a pleasing thing, return to it, become familiar with it, inculcate its aspects into experience; for months the hand felt only what came or was given to it, so that the most pleasing of sensations might have been forgotten before it could be repeated. Hence the development of the perception of objects of sight was considerably in advance of the development of the perception of objects of touch, which began to assume noteworthy proportions only after the child could see (carry into his visual field) that which he handled.

SECTION III.—TASTE AND SMELL.

The records which I gathered upon the sensations of taste and smell were very meagre. I was unwilling to experiment upon the sense of taste, since substances introduced into the mouth must inevitably have found their way, as a whole or in part, to the stomach, whose normal processes might thus have suffered disturbance. From the first, water was given to the child daily; this he seemed to enjoy.

On the twenty-first day some soda mint in hot water was administered. He swallowed it, as he did water, giving no evidence of having experienced a different flavor. Thereafter until the twenty-ninth week milk and water were the only food substances which passed his lips. In the thirty-sixth week he received his first meal of artificial food, consisting of sterilized cow's milk slightly sweetened with cane sugar, and this he seemed to like.

In the thirty-eighth week his objection to solid food in the form of sugar, and thickened cream from the sterilized milk, was very strong.

In the forty-sixth week he refused bread and milk, probably because it too was solid, but was extremely fond of cow's milk alone. In the forty-seventh week he learned to suck a crust

of bread, and doubtless in this way got its flavor. Thereafter he liked bread greatly and soon learned to swallow it.

In the fiftieth week he was given in water some medicine having a saline taste, which he liked. In the fifty-second week he was given some of the juice of an orange, which he liked at once, and of which he soon became exceedingly fond. In the fifty-eighth week he objected to a bitter medicine, even when sweetened and mixed with orange juice. In the sixty-fourth week he ate crackers and grew to like them very much. He ate also a little potato, bread and butter, broths, custards and boiled egg, each of which he seemed to like when first given to him, but no one of which tempted him when it appeared a second time. Indeed he often refused a food which had at first seemed agreeable to him. It would seem that the different flavors were not severally disagreeable to him, but they were not sufficiently pleasing to create a desire for the articles to which they belonged.

By the seventy-sixth week he liked salt greatly, and would have eaten it by the spoonful; sugar he refused to eat, but he liked to play with it. Throughout the second year he continued to like juice of oranges, grape fruits or lemons (the last in lemon jelly), also apples and grapes. He did not care for sweets,[1] but continued to demand salt. Milk, bread and butter, and fruits constituted the staple articles of his diet; other plain foods he sometimes took and sometimes refused.

From the above scattered records it may be learned that certain simple tastes were pleasing to the child in themselves, and at least one, bitter, was disagreeable to him; but that the flavors of the mixed foods were responded to with indifference.

Smell.

During two years the child gave no evidence of a great sensibility to the influence of odors. But by the end of the first month the odor of milk was undoubtedly one of the signs by which he recognized the near presence of his mother. From the second month until complete weaning had been accom-

[1] In the third year he liked pure cane sugar and maple sugar.

plished proximity to his mother suggested feeding. Early in the third month the experiment was made of holding close to the child a cloth moistened with milk. He began at once to act as if hungry. The experiment was so arranged that smell must have been the only sense to which an appeal was made. If sweetly scented flowers were held close to his nostrils during the fourth month and later, his face often wore an attentive expression. Of course he never inhaled the perfume as adults do, and it is not even certain that he perceived it.

In the eighty-sixth week he began to ask to have flowers given him to smell, and leaves also. When his mother's hand, wet with coal oil was offered to him to smell, he smelled it and seemed pleased, wanting to repeat the performance many times. He also insisted upon smelling the cosmoline as soon as the bottle appeared.

In the twenty-third month he opened an old box in which some rose perfume yet lingered. This he at once perceived. It would seem that odors had not for him the distinctness and individuality which they have for older people. He did not learn to inhale properly, therefore, it is probable that he did not experience to the fullest, the sensations of smell.

PART III.—IDEAS.

SECTION I.—MENTAL DEVELOPMENT.

In the parts devoted to the consideration of movements and sensations, evidence has been brought forward to show how these are the forerunners of all mental development. But sensations and reactions alone are not sufficient to account for mental progress. A great expanse existed between any sensation, or group of sensations, and an idea. What united the ends of such a series? By what processes was an idea built up from one, or from many sensations?

Sensations and reactions heaped one upon another never could have developed an idea. The processes by which ideas were built up were after all not so many, nor so complicated, as we are accustomed to suppose. It is not too great a claim, as a result of these observations, to maintain that idea formation rested upon a few simple processes, easily recognized and leading to a progressive series of planes of mental development.

Sensations and reactions furnished the materials of all ideas, providing an immense number and variety of elements. Some of these elements were gathered around limited sets of experiences. Whenever this was the case, associative links were formed uniting sensations, movements and experiences into fixed connections. The formation of such associative links was a first step towards mental development. The earliest manifestations of memory were given in such associated connections. During the first months of life I saw no evidence of memory except as presented in series of associations whose recall was initiated by suggestions.

The memory of the young child may be said to have shown itself in the ability to record. In a last analysis memory coincides with habit, memory being the making of a record of what had been experienced; habit, the tendency to act again as he

had acted before under similar circumstances. Both rested ultimately upon a common foundation and found no differentiation in the young infant; for, given the recurring conditions as a suggestion, and there was in either case recall and action.[1] If we arbitrarily separate the association series from the action series, we shall find in the former the first expression of an individual memory; but in making such a division we must not for a moment lose sight of the fact that no such severance actually occurred.

The chief factor in the development of apperception and in the organization of apperception masses was found to be the qualitative connection of experiences. When examining into the development of the perception of things seen and heard I have, in a measure, forestalled and outlined this position in regard to apperception. I have there pointed out that every variety and combination of sensation was not, at a given time, possible to the child; but that the sensations which he might then experience were dependent upon the stage of development of the sensory apparatus, the use made of previous experiences, and the power of the stimulus to engage attention. I have shown that a sensation utterly disparate from all perceptions previously obtained, did not receive the share of attention which was necessary in order to impress its effects upon the mental organization. No experience took its place in the mental life of the child which did not fall into the line of connections by which past and necessarily somewhat similar experiences were united.

Apperception was the assimilation *in continuity* of the new and similar in experience with the old; and apperceptive masses were the associated groups of experiences. The paths along which apperception might be effective, and the limits within which apperception masses might accumulate, were fixed by the laws of sensation and movement, and by the order and succession in which the sensory apparatus became instrumental as a means for the acquirement of perceptions. If the reader will recall that portion of the introduction which told of the periods

[1] For illustration consult Movements, pp. 17 and 18, 1st to 49th days.

[2] See Sensation, pp. 58–60.

of development and activity within the various territories of sensation[1], he will be aided to a better understanding of the meaning of these statements. He is also referred to Touch, p. 82, where it was shown in part why sight succeeded in attaining to a higher plane of development than touch during the first of the periods described.

One more reference to facts already established will make clear how close we stand to the central point from which lines of mental development diverge. In treating of vision[2] I have endeavored to explain the method by which the range of perception became increased. If the reader will now refer to the statements there made, the close relationship of perception and apperception will become apparent.

When the simplest memory is regarded as the retention of the impressions of experience; when personal memory is seen to be the retention of definite and interrelated series of experiences; when habit is found to be the tendency to repeat an act upon the recurrence of conditions which suggest it; when perception is admitted to be the reference of sensations before experienced to stimuli whose effects have been felt before; when apperception is found to be the assimilation of new material with what has been obtained through experiences in the past; when memories, habits, perceptions and apperceptions are understood to rest upon sensations and movements, and upon the ability to establish connections among the mental representatives of the same, we find ourselves on a vantage ground of comparatively simple manifestations from which to view the paths of departure that lead to the so-called faculties of the mind.

One question has doubtless presented itself to the reader as a stumbling block in the way of the acceptance of the above analytic simplification. The part played by attention in the scheme of development has been everywhere noted, in particular receiving consideration under vision. What is attention, and among what class of activities does it belong? Attention is to be regarded as an adjustment to the influence of the stimu-

[1] Introduction, pp. 4–6.

[2] Sensations, pp. 58–59.

lus;[1] thus it is cast into the class of inherent reactions. It differed from the inherent reactions of the special senses in this, that under the necessary conditions it could be called forth by the stimulations of any sense. In common with other inherent reactions the course of its development was towards its final (but not complete) subjection to voluntary control.

It is often stated that the ability to attend increases with age, and that the little child is quite unable to settle himself to the contemplation of one thing for any length of time. I do not know how true this may be of children in general. I am prepared to deny the truth of such a statement in the case under consideration. No doubt the ability to attend voluntarily does increase with age—of this I cannot as yet speak—but the power to attend involuntarily was established immediately after birth, and was manifested whenever the sensory apparatus was employed.

An older child could not do more to evince attention than to lie gazing at a patch of light or a moving object during a period varing from fifteen to thirty minutes. As he became older the same things did not interest the child in the same way. After touch had been developed through handling, he often occupied himself for an hour or more with a single object. In such cases a factor entered which was not found with the earlier sensations; namely, the continual changes which the child himself induced in the object, as a result of which he perceived it in new situations which were in truth like so many changes in stimuli, each requiring a fresh adjustment of the attention. Hence the infant when older amused himself for a longer period and seemed to attend for a longer time. It is true, the attention of the child daily became subject to a greater number and variety of diversions as he became, through his developed perceptions, sensitive to a wider range of influences which he was not able, nor did he will, to shut out. This fact alone might lead to the assumption that his attention could not, under any circumstances, remain fixed for more than a few moments —an assumption not borne out by the full evidence.

[1] As such it is regarded by Wm. James, Psychology, Vol. I., Chap. on Attention.

Concerning the emotional factors determining the mental survival of experiences, it is to be noted that there were at first no evidences of emotion other than those of comfort and discomfort. The sensations first assimilated were connected with bodily feelings of well being—the satisfaction of hunger, dryness, warmth, etc.[1] On this purely personal foundation all subsequent development was built up. Along with intellectual evolution there occurred a differentiation of emotions. In so far as those degrees and complexities of feeling and thought to which we are accustomed to refer as the emotions, were severally called forth by the situations in which the child was placed, they became instrumental in determining lines of activity and of survival. As the child became acquainted with things an interest in them was developed which became the chief determining influence of survival.

We have now seen: (1) The point from which the lines of mental activity diverged; (2) the means by which the mental outlook was expanded; (3) the connection of the successive view points or apperception masses; and (4) the motive of such connection.

The processes of mental elaboration remain to be described.

Reactions have already been so fully treated under movements and sensations that from this point I shall omit all special consideration of them, giving them only incidental mention where necessary. Suffice it here to make the general statement that reactions were to be found corresponding to any plane of development upon which the child stood. There was a graduated series of such reactions extending along the pathway from sensation to idea.

Sensations, as I have pointed out, were developed around certain centers. These centers were objects of the environment acting in various ways as stimuli. When a given center with its associates stood out in consciousness from other centers and clusters, which were all the while forming, that particular center was distinguished. Intermediate between sensations and such distinctions there were perceptions and recognitions. It is not

[1]It has already been shown that the first movements to be developed were connected with the attainment of comfort. Movements, p. 43.

possible to ascribe a fixed time limit to each stage of development, because when a stage was once reached, necessary and useful gains either continued to appear in their original form, or led to further progress through a series of transitional changes; yet a rough time estimate may be made for each period. Thus the child may be said to have been in the sensation stage during the first month; in the perception stage during the next three months; and at the beginning of the stage of distinction with the entrance into the fourth month. That he was always in a stage of association must not be forgotten, for the continual formation of associations was one of the very noticeable features of infancy.

In speaking of distinctions I do not wish to convey the idea that discrimination, or the perception of analogy, were involved in this separation of object from object, which (separation) was based upon recognitions[1] akin to such as have been described under hearing.[2] When the child was in the stage of distinction the objective reference of sensation was fairly well established. In this stage he looked for the source of stimulation outside of himself and found it in some object whose qualities were associated as they influenced him and were fused into his personal idea of the object. Such ideas were necessarily incomplete. At first they dealt with comparatively few objects, but the circle widened by degrees. As he became able to sit, to creep and to walk he was brought into fresh contacts and was enabled to form new distinctions. This he constantly did.

In discussing sensation, movement and association I have used the expression 'mental representative' without having attempted to explain what the nature of a mental representative was. Such an explanation I cannot make without entering a field of conjecture. That the mental representatives of the early weeks were the forerunners of true mental images or representations there can be no doubt. Early mental images did not deal with objects as wholes. Each was the result of a mental synthesis of feelings derived from particular contacts. Some of the later ideas were the outcome of experiences with objects

[1]For illustration of recognitions see appended table.

[2]Sensation, pp. 67–68. Of this part.

perceived as wholes. A study of the desires of the child gave some insight into the nature and number of his representations. When the child could by the use of language show that he wished to have an object not present to sense we may conclude that he possessed a representation of the object complete enough to be associated as a central figure with feelings of pleasure. Some representations had undoubtedly been formed by the ninth month, but it was not till the second year that the child showed himself to be possessed of a number of fairly complete images. In Part I.[1] it was shown that the child came to be practically at the mercy of such images, which through suggestion exercised the controlling influence upon his activities. It was apparent that his memory images were not bound to the the terms of one sense. That the child belonged to one of the so-called types I have never been able to ascertain. A study of his recognitions pointed to the conclusion that he was not of determined type. Up to the close of the first year the representations or memory images were of a very primitive kind. Whatever may have been the number of sensation elements which had entered into the formation of one of these memory images, and however complete a representation of an object such an image might have been, it was nevertheless not associated with other images or representations in such a way that one was able to call up another. Memory images were not associated with one another independently of objective suggestion before the second year.

It is easy to understand why comparisons and discriminations were rarely made before the second year, for how could one object be measured against another which it had not the power to call up? And in the case of the perception of similarity, how could that occur before one mental image could call up another? During the second year, and especially during the second half of this year, associations were gradually formed connecting mental image with mental image. Thus chains of images, of acts, persons, words, etc., were formed and the mental life became far more complex.

But even at the end of the first year the child had practi-

[1] P. 31.

cally no mechanism of voluntary recall. In order to recall anything it was necessary to reach his memory for it through the suggestive influence of recurring circumstances, some of which must be the same, or very similar, to those which had formed the original setting of that which was to be recalled; for example, the child, having laid down and left a toy for a time, was not afterwards able to recall its whereabouts, though he desired greatly to find it. If, however, he happened to find himself in the place in which he had previously left the article, he at once remembered about it, and demanded it if it were no longer there.

In the second year his natural retentiveness was remarkable. The time during which the accurate memory of an incident was preserved was a frequent source of surprise to his elders. Yet his memory images were not held in words, nor had the child himself any evident control over them.[1]

Beginning in the twenty-first month, I made a few experiments in order to learn something of the nature and duration of these memories. The following facts were revealed: When the memory image did not fuse with a class idea it could persist distinct and full as to its details for from six to eleven weeks (eleven weeks was the experimental, not the real time limit); where it did fuse with a class idea it lost its distinctness and individuality in a period of time which varied in length according to the stage of development of the class idea with which it fused. If the class idea was in process of formation and rested as yet upon but few representatives of the class, each of those few was naturally more distinct than it would be at a later day, when many representatives had contributed towards the making of the class.

Thus far I have everywhere spoken of associations simply as such, without pausing to define the kind of association with which we were dealing.

I now wish to show, first, that what is commonly called association by similarity is as fundamental a type as association

[1] During the third year the feats of memory became more noteworthy; it was a matter of daily occurrence for the child to refer spontaneously to events which had taken place three, six, nine and even twelve months earlier.

by contiguity, even though it be a somewhat less primitive one; second, that association by similarity led to (*a*) the perception of analogy (*b*) discriminations (*c*) inference; and third, association by contiguity lay at the foundation of (*d*) reproduction, and (*e*) reconstruction.

It has been said that the representations and ideas of the child were formed by the union of diverse elements. It has further been stated that there was in each representation a central or principal element around which the others were clustered. Upon such foundations there occurred two forms of association which may be somewhat approximately designated as association by contiguity and association by similarity. In the form first named the series of connected memories was called forth by the repetition of the leading circumstances—it was that form which depended upon the existence of identity. In the second form we have the series of connected memories called forth by something (either object or experience) not identical with the center to which the cluster belonged, but enough like it in one or more particulars to be effective as a means of recall. There were a few rare instances of confusion of identity, the second suggestion resembling an earlier one closely enough to bring this about. Associations of simple contiguity predominated at all times. In the ninety-eighth week I found every act of the child during the greater part of a day to be connected with such associations. Associations of similarity began to occur about the fortieth week. They were the descendants of recognitions, and began, not in the association of like object with like object, but in the power of certain elements to suggest a well known experience. They began in the suggestive power of elements forming the bases of recognitions; but as object became separated from object, and experiences became multiplied, these associations grew to consist in the suggestion of an image by a similar object.

Association by similarity and association by contiguity met in an undifferentiated process at a time when objects were not recognized as wholes, when the child responded to features of the environment and not to things perceived as such.

Elements always continued to be suggestive; in fact, they

became more suggestive as time went on, but the suggestion of object by object was not of common occurrence before the seventy-first week. Through association by similarity the mental juxtaposition of like objects was brought about, as a result of which the perception of analogy was developed. It will now be seen in what manner the ability to discriminate was genetically related to association by similarity. There was an opportunity for the development of discrimination only after an object present to sense could call up the representation of one not present.

The perception of likeness and of difference are often spoken of as though they were separate aspects of the same thing. In the present case the perception of likeness was not the reverse side of the perception of difference. As a matter of fact, it was developed while discriminative power was in its infancy. Both belong to the third, rather than to the second year.

The study of many cases of childish inferences reveals these characters to be common to all. Each was based upon past experiences. The premises from which the conclusion followed were elements common to both past and present experiences, and both premises and conclusion fell within the 'apperceived system' of the child.[1]

In Language it is said that the extension of the meanings of words depended upon inferences of a crude form. This is the form to which I there referred. Likewise all errors and all spontaneous interpretations of phenomena were inferences based upon the suggestions of similar elements.

What is familiarly known as imagination was the reconstruction and rearrangement of what was already at hand. In its most primitive form, that in which associations by contiguity were involved, chains of experiences were reproduced in the order in which they had been met; but as the child became able to perceive likenesses and differences, and true internal associations became possible, one representation could suggest another quite independently of original contiguity arrangement.

[1] "Inference cannot possibly take place except through the medium of an identity or universal which acts as a bridge from one case or relation to another. * * * * Ultimately the condition of inference is always a system." B. Bosanquet, The Essentials of Logic, pp. 139–140.

Thus reconstructions involving a greater number of processes began to occur about the close of the second year.

A few points remain to be mentioned before the subject of mental elaboration is laid aside. The first of these is concerned with the nature of the child's ideas. Had he class ideas resembling our own? During the second year he undoubtedly had some, but not a great many, and those that he possessed had grown up as the result of an extended series of experiences with the objects which we are accustomed to designate by class names (dogs, cats, men, women, children, dishes and chairs are a few of them).

His words, as a rule, had a definite content, a fixed relation to the object or phenomenon to which they applied. The fact that they were rarely used just as we use words, and with the meanings which we are wont to attach to them, might lead to the error of supposing that the meanings which the child himself attached to his words were vague. It has been shown that abstract words did not occur in the vocabulary; had I space in which to do so I could show by a citation of special cases that he had no abstract ideas pertaining to his concrete words. A close observation of the meanings attached by the child himself to his words showed that those which had not reference to some one occurrence or object related to one or more aspects of experience upon the basis of which things possessing these in common were designated by a common name. For example, the verb *to spill* meant voluntarily to tip the mug or glass and pour some fluid therefrom, while the verb *to find* referred to the act of appearance under the greatest variety of circumstances.

All ideas of the first year were not connected with words. The ideas of the second year were formed along with the learning of words and were modified accordingly. The formation of ideas did not depend upon words, but upon perceptions obtained directly from the world without the child. Nearly to the close of the second year language belonged to the apperceived system, and was not in its beginnings a prime factor in the development of thought. Late in the second year language became a channel for the conveyance of thought.

Special care must be taken not to fall into the error of as-

cribing indefiniteness to the ideas of the child—an error which has arisen out of the custom of measuring his ideas by the standards of our own. When a representation had been evolved it was concrete and limited. It is true, it did not represent the whole object together with its uses in the sense in which we conceive of a thing, but it did represent very definitely the object in its relations to the child himself. In the second year was it indefiniteness which compelled him to perform day after day the same round of actions? Not at all, for it was the circumscribed and closely knit groups of associations which controlled the direction of motor discharge, and which in a given case was only finally broken up by the interpolation of a new product of experience.

It has already been stated[1] that in no case did a subsequent synthesis require an amount of time for its construction equal to that which had been consumed in gathering the materials and building the first synthesis of a series of related ones. The ability of the child to form such syntheses increased with practice till it became habitual to him to form them. What the process was by which the mental synthesis of the associated representatives of sensations was accomplished I cannot say. Yet it was certain that after the fourth month some cluster of associations daily passed through the transforming process and became the mental representative of a thing. The history of childish generalizations and of so-called errors showed that representations were often formed upon incomplete experiences; namely, a few sensations, incorporating material drawn from memory. In early infancy errors rarely occurred, and it was not till many associations had been established that errors arose. In early infancy each synthesis was based directly upon sensations connected by contiguity; while in later infancy new experiences did not stand alone, but were instantly placed, as if by necessity, in some arrangement with those of the past. Such an arrangement might or might not correspond to the objective one. If it did not so correspond the resulting incongruity might be designated an error. What I have called a necessity was the mental habit according to which it was so placed.

[1] Touch, p. 78.

Inference was not the only form of reasoning of which there was evidence. Generalization and induction[1] also occurred, and if they were less conspicuous than inference it was because a longer time was required for their accomplishment. It seems to me that an embryonic induction was manifested when the child refused to reach for an object whose distance from him was greater than the length of his arm; for, whatever the mental terms in which a knowledge of distance was given, it is certain that he had the knowledge, and that it was a permanent measure which had been given to him out of the common element of innumerable separate trials. The same might be said of his ideas of magnitude, depth and direction. A good example of induction occurred in the second year. About the one hundredth week the child became impressed with the 'againness' of experiences, and constantly remarked upon it with surprise. On coming to the table he looked at the various dishes, viands, etc., exclaiming at each, "Here it is again!" Likewise if a member of the family returned after an absence he never failed to notice the reappearance in a similar manner. After some two weeks of this he acquired a confidence in reappearance and recurrence—derived a principle, as it were—and began to state in a positive manner that such was to be expected. When he had gotten to this stage he cheerfully saw his mother go away, asserting that she would come again, whereas before he had been loth to have her leave him.

Under voluntary movement[2] I have spoken of an influence exerted by reason in determining the course of a discharge as early as the forty-sixth week. But I did not show what we are now in a position to observe; namely that the higher forms of thought were developed with the more complicated movements and existed in embryo before abstraction was to any extent possible, and that inference, induction, generalization and reconstruction were mental habits in the same sense that sitting, creeping, etc., were habits, and that each mental habit was developed by a method similar to that found in the development of a bodily

[1] "Really induction is only a popular name for such inference as deals with numbers of instances." H. Bosanquet, op. cit., p.163.

[2] Part I., Sec. 2.

habit, becoming fixed as an active factor in mental life and the means of further acquirement very much as each habit of the body did. Thus we find two systems of habits developing side by side and mutually dependent. And with them two systems of ideas, to the first of which belonged those derived from experiences with things, and to the second those resulting from the use made of experiences according to the habits or processes of mental integration and elaboration.

A careful examination of the two tables which are herewith appended will facilitate the understanding of the statements that have just been made. These tables will he found to be self explanatory, and need not detain us longer here. I shall therefore proceed to sketch in outline the course of this development of an idea which is added, with the tables, in the hope of giving definiteness and clearness to the above exposition. The idea selected for the sketch had its beginnings in the most primitive experiences of the child. This was the idea of his mother; it was, in fact, the only idea that referred to an object which was not a part of himself, and which yet was an ever present factor of his environment. From my notes I have selected a few of the salient points in the growth of this idea.

In the beginning the child sucked whatever was put into his mouth, whether this was his own finger, the nipple or the corner of a pillow. He usually suckled with his eyes closed. On the fifty-fifth day he began to keep his eyes open while suckling, letting them wander over the dress, breast and sometimes the face of his mother. Through seeing her face so frequently in other situations than this he became independently familiar with it, and began to associate the sight of her face with his own comfort. But it was not till the thirteenth week that he identified the face above the breast with the one familiar in other circumstances.

In the tenth week he began to notice his mother's dress, being at once attracted by a change in it. In the fifteenth week she wore a dress at which he often looked, yet three weeks later, lying on the floor beside the chair in which she sat he was at first interested in the dress, then became lonely, beginning to worry as if though she were away, and finally was surprised

when he chanced to discover her face just above him. It was not till about the twenty-seventh week that he began to connect a skirt, moving or at rest, with a face above it. As early as the tenth week he was dissatisfied if his mother sat near him with her face averted, and only ceased to worry when she altered her position, yet in the fifteenth week it startled him to see her face alternately with the back of her head. In the fourteenth week he often felt her hair, but it was not till the forty-fourth week that he was interested in watching her put it up, and it was late in the second year before he understood that it could not be taken off of her head and given to him.

By the thirty-eighth week the satisfaction of hunger had become so closely associated with his mother that, although nourished better by artificial food, he refused it from her hand, while he accepted it readily from his father if his mother were not in sight. In the thirty-eighth week he recognized his mother's hand as similar to his own, and later other parts of her body and portions of her clothing. Such recognition, however, did not extend to parts of which he did not have experience, for in the one-hundred-and-third week he insisted that her neck, which he saw between the ends of her collar in front, was her back. In the sixty-sixth week he was distressed to see her in an unusual attitude, her arms outstretched above her head. By the eighty-third week her clothing had become so completely involved in his idea of her person that he was shy with her when for the first time within his recollection she appeared dressed for a social event. In the forty-first week he showed a decided preference for his mother over other people. In the forty-eighth week he began to regard her as exclusively his, and resented attentions shown her by anyone else. In the second year he did not like to have her attention engrossed by other people and things. About the ninety-seventh week he began to understand that other children had mothers of their own, but it was difficult for him to grasp the idea of one mother for two children.

TABLE II.—DEVELOPMENT AND RELATION OF RECOGNITION, INFERENCE AND RECONSTRUCTION.

Simple Recognition Based on Experience.	Recognition Connected with Expectation.	Inference, the Habit of Basing Conclusions upon Analogous Items of Experience.	Reconstruction:	
			Either a Simple Reorganization of Experience;	Or, a Reorganization Involving an Inference.
5th week: He recognized the human face. 7th week: The sounds of the voice. 9th week: He recognized the breast when he saw it; and the face of his mother. 12th week: His own hand. 16th: His thumb; the nipple. 17th: He recognized his ball at a distance of some feet. 18th: Footsteps on the stairs. 24th week: He recognized his grandfather, whom he had not seen for two weeks.	21st week: He recognized hands extended to him and expected to be taken up. 22d week: The spoon, and prepared to receive water. 23d: His mother's hat, expecting to be taken out when she wore it. 27th: He recognized a tune, and expected it if he saw the movements which accompanied the song. 35th: Repeatedly threw his spoon on the floor and looked after it; sometimes he held out his hand as if to receive something, seeming to expect it to come to him.	24th week: He tried to take the hand of his own reflection in the mirror. 25th: Seeing a visitor wearing a hat he evinced delight; when she went out and did not take him he was distressed. 59th: Seeing a cow for the first time the child called her a bird. 64th: A caterpillar he called a fly. 83d week: In the afternoon the child walked in the station with his parents and rode in the street car. In the evening he and his mother went back to the station alone. When the child found himself next to a man in the street car he called him papa, and insisted upon getting up	81st week: He threw his baby doll on the floor and ran into another room calling "Bye, bye, baby!" Then exclaiming, "Poor baby cry!" he ran back and picked it up. He laid the doll on the bed springs and worked them up and down, giving the doll a ride as his grandmother rode him. 93d: Upon going into the bath room he asked for a large empty bottle which was often given him to play with. Having received it he said, "Mamma, neck." His mother, who was busy, did not heed him. Then he said, "Mamma, hand!" and taking her hand he got her to sit	66th: He found on the floor a bit of black wool about the size of a fly which he at once called a fly. He picked it up, carried it to the window and stuck it on the screen. Then pointed to it, exclaiming, "fly! fly!" a number of times.

TABLE II.—DEVELOPMENT AND RELATION OF RECOGNITION, INFERENCE AND RECONSTRUCTION.—*Continued.*

SIMPLE RECOGNITION BASED ON EXPERIENCE.	RECOGNITION CONNECTED WITH EXPECTATION.	INFERENCE, THE HABIT OF BASING CONCLUSIONS UPON ANALOGOUS ITEMS OF EXPERIENCE.	RECONSTRUCTION:	
			EITHER A SIMPLE REORGANIZATION OF EXPERENCE	OR A REORGANIZATION INVOLVING AN INFERENCE.
34th: Changes in the facial expression of people. 43d: He recognized and imitated a number of sounds. 56 h: The child liked to stand on a chair and look out of the window. If his mother moved the chair towards the window, calling him to come, he hastened towards the window; if she spoke the words without moving the chair, or adjusted the chair without addressing him, it meant nothing to him. 75th: A little playmate who had been away for four weeks was upon	44th: His father was accustomed to take him from his chair every evening after dinner. When the child saw his father fold his napkin he was delighted, expecting to be taken up. 44th: When he saw his mother brush her hair (an operation usually performed before donning her hat) he expected to be taken out. 46th: His mother was accustomed to sit in a certain chair. One day the child saw his mother in the room, but while he was playing she took her seat in another chair. He soon looked at her chair, and not seeing her	on his lap, all without having looked in the man's face. In the station he ran after a man who walked a little in advance, calling him papa. When the man turned his face, the child at once saw that he was not his father. 87th: He called a watch a clock. 95th: A picture was shown to the child. It represented a girl standing on a road in front of a fence. Her shadow lay on the ground behind her. He was asked to point out her shadow. He looked on the fence for it and could not find it, neither could he on the next day satisfy him-	down beside him. He then went through the performance of tipping the bottle as if pouring something out on his hand with which he afterwards rubbed his mother's neck as his had been rubbed with oil some three weeks before. 101st: Ke put the scissors on a book and said they were riding on horseback. 103d: He lost a pin which fell down a crack. When he complained that it was gone his mother asked him where it was. He replied: "Gone to church; gone a sleigh ride." He saw	103d: One day, while out, the child saw a man standing in the midst of a flock of chickens. He was too far away to see what the man and the chickens were doing; but

TABLE II.—DEVELOPMENT AND RELATION OF RECOGNITION, INFERENCE AND RECONSTRUCTION.—*Continued.*

SIMPLE RECOGNITION BASED ON EXPERIENCE.	RECOGNITION CONNECTED WITH EXPECTATION.	INFERENCE, THE HABIT OF BASING CONCLUSIONS UPON ANALOGOUS ITEMS OF EXPERIENCE.	RECONSTRUCTION:	
			EITHER A SIMPLE REORGANIZATION OF EXPERIENCE	OR A REORGANIZATION INVOLVING AN INFERENCE.
his return immediately recognized. He was seen for the first time in his wonted surroundings.	there began to worry as if alone, looking repeatedly at the chair. At last he chanced to perceive her, was satisfied and began to play again. Soon he looked up at her chair again, and, evidently having forgotten where she sat, behaved as at first. After having a second time discovered her he remembered where she was. Nor did he on the next or following days have trouble in remembering where in any part of the room she sat.	self as to the shadow which he sought to find on the fence. 95th: He went with his mother to a strange house. He ran about the rooms examining everything. Of a large standing lamp he said: "See the big tree;" of the books behind glass doors: "See the books in the window!" 98th: In the forenoon he saw a neighbor sweeping snow. In the afternoon when questioned as to her whereabouts he replied that she was sweeping the snow (he had not in the meantime seen her). 100th: Seeing his mother tacking down an oil cloth on the kitchen	'bizz' (his own moving shadow) on the floor and watched it. When asked what 'bizz' was doing he replied that 'bizz' was eating a big apple.	was told that the man was feeding the chickens. The next day he described to his mother what he had seen, adding that the man fed the chickens with beef tea from a cup.

TABLE II.—DEVELOPMENT AND RELATION OF RECOGNITION, INFERENCE AND RECONSTRUCTION.—*Concluded.*

SIMPLE RECOGNITION BASED ON EXPERIENCE.	RECOGNITION CONNECTED WITH EXPECTATION.	INFERENCE, THE HABIT OF BASING CONCLUSIONS UPON ANALOGOUS ITEMS OF EXPERIENCE.	RECONSTRUCTION:	
			EITHER A SIMPLE REORGANIZATION OF EXPERIENCE.	OR, A REORGANIZATION INVOLVING AN INFERENCE.
		floor he exclaimed that the kitchen was broken (he had seen things mended with hammer and tacks.) 101st: The corner of his napkin bent up against his face, and this he attributed to the wind which blew under his cape and raised it in a similar manner. 103d: He broke the petiole from the blade of a leaf and asked his mother to mend it. She replied that she could not do so. He sat as if thinking for a few moments, then looked up and said, "Mamma mend(ed) the sofa; mamma mend(ed) the rabbit."	104th: The child gave his mother a pin; then offered one to his aunt (not present) and to many other persons whom he called by name, extending his hand now here, now there, as if giving the same pin to each in turn.	104th: His grandfather showed him the picture of a bunch of grapes, and promised that when the child visited him he should pick grapes. In a few weeks his grandfather went home. Thereafter the child in telling about his grandfather always represented him as picking grapes.

Table III.—Associations.

Early Associations.	Contiguity Associations.	Transitional Forms.	Similarity Associations.
4th day: Turning the head towards the cheek touched. 17th day: Rolling the head from side to side with open mouth when in discomfort. Turning the head towards the breast against which he happened to lie. 30th day: Turning the head to the side from which sounds came. 33d day: Turning the head in order to follow with the eyes. 35th day: Sucking the backs of the hands he associated with sucking the thumb. 36th day: Grasping was associated with hand contacts. 38th day: Holding with grasping. Balancing the head with looking. 55th day: Being held on the arm with feeding. 59th day: The sight of the breast with feeding.	38th week: The word mamma was associated with uncomfortable feelings (hunger, wetness, etc.). 46th week: He connected a certain chair with his mother, and looked for her there. 50th week: If his mother said, "here comes papa," the child stopped his play, listened for his father's footsteps, then hastened towards the door. 64th week: Having twice seen the cracker jar and received crackers from it, the child expected them when he saw it approach. 72d: When the child saw his mother sit down on the floor to put on her shoes, he took them to her, and, saying "da! da!" handed first one and then the other. 77th week: A certain fur rug was sometimes laid over the door step. Upon several occasion a cracker had been given to the child to eat while sitting	30th week: The child had been drumming with a ring or spoon upon the table of his little chair. When for the first time he drummed with his hands upon the upright piano he was surprised that the sound did not come from beneath his hand. 33d: When given an orange to play with he handled it without awkwardness, evidently applying to it movements and adadjustments acquired in playing with his balls, which were considerably smaller. 70th week: In this week the child developed a method of going downstairs which he applied to inclines. Face towards the step and feet downward he slid from step to step. When going down a terrace he slid from top to bottom. 84th: When the child pulled his mother's hair she cried out; when next she brushed his hair he made a similar exclamation.	71st week: The child was given a hen's egg of the size, shape but not color of a darning egg which he had not seen for two weeks. He at once tried to separate the two halves as he had done those of the wooden egg. 87th week: A watch suggested to him a clock, and he so named it. 92d week: A copy of the Sistine Madonna, measuring 18½ in. x13½ in., in the sitting room was a picture which often attracted notice and comment from the child. One day, in looking through an art catalogue, he came upon a small copy of this picture, 2½x4 in. He regarded it intently, then turned and looked at the large picture as if comparing them. This he did several times. 94th week: The stopper of the bath tub he called a cork. He called a ten pin a bottle

TABLE III—ASSOCIATIONS.—*Concluded.*

EARLY ASSOCIATIONS.	CONTIGUITY ASSOCIATIONS.	TRANSITIONAL FORMS.	SIMILARITY ASSOCIATIONS.
10th week: His mother's face with his personal comfort. 12th week: The appearance of his mother was connected with the satisfaction of hunger. The sight of his mother unfastening her dress with the satisfaction of hunger. 16th week: Waking at night with being fed. 17th week: The palm of the hand with grasping. 18th week: Her voice with his mother. Pulling himself into a sitting position with being held by both hands. The sight of a cup with a drink of water. 19th week: Movements seen with a song heard. The thumb stall with the inhibition of sucking.	on this rug. Thereafter when he found himself upon it he was accustomed to call for a cracker. He called for a cracker also when he heard a tin box rattle. 83d week: One day his mother, after blackening her own shoes, seated the child on a chair and blackened his. Ten days later he entered the room while his mother was blackening her shoes, climbed on a chair and held out his feet to have his done. 93d week: When he saw someone lift off the shade to light the lamp he called by name the person who was accustomed to remove the shade to fill the lamp. 96th week: If the child was told to call his uncle, he called instead his aunt, whom he always saw with his uncle, 97th week: The postoffice and a letter were so connected that if he heard one mentioned he was sure to speak of the other.		and played at giving his doll a drink from it. He called a filbert nut an egg. 99th week: Little pieces of wood shaped very much like books and about half an inch square the child named books. 100th week: Some one gave the child a small oval box containing turtles whose limbs and heads trembled. Some artificial flowers and leaves occupied spaces about the turtles. The whole was covered with a piece of glass secured to the margin of the box. He named the turtles flies and said the flies were taking a bath in the bath tub. Wishing to have the glass removed he asked to have it cut off. 104th: The top of the sewing machine lay on the floor inverted. The child threw in a paper (the nearest thing at hand) exclaiming, 'Paper, take a bath!'

SECTION II.—TIME.

The experiences underlying the perception of time may be divided into two classes. To the first class belong those experiences which had to do with periodicity; to the second those which formed sequences. The experiences of periodicity related to the functions of the body—sleep, nutrition, etc.—and came to consciousness in the form of recurring wants. No time regularity in the recurrence of these wants was established previous to the sixth week. In the case of nutrition this was owing to several causes, the most significant of which were the susceptibility of the child to fatigue and the long hours of unbroken sleep, which operated against the methodical apportionment of the day. By the fourth month the child became hungry and sleepy at regular intervals and at fixed hours. The regularity of the recurrence of the feeling of hunger was most marked; for it was a matter almost of certainty that he would awake within a few moments of the hour for feeding, though it had never been customary to arouse him for this purpose. From the second to the sixth month intervals resting upon periodic functional performance were the time data. That consciousness was aware of each of these recurrent experiences was clear. It was through the acts, feelings and perceptions which accompanied it that each was known.

The intervals between the satisfaction of the physiological requirements gradually became filled with successions of daily experiences, so that from morn till night there was a chain of major events each of which suggested its next in order. In the eighth month the child became cross and refused to be satisfied if at the usual time he was not taken for his daily airing; and this was because he recognized the events which usually preceded his going out, and not because he perceived the time. That an abstraction such as we are wont to designate as time resulted directly from this periodic and serial arrangement of experiences, I am not prepared to maintain. Late in the second year his daily performances became associated with the clock through the references which he had heard to the hour in

connection with what was about to be done. Thus his own intervals were brought to bear upon the acquirement of that human concept—the idea of time.[1]

SECTION III.—DISANTCE, DIRECTION AND MAGNITUDE.

The perceptions of distance, direction and magnitude, involved as they are with the conception of space, rightfully belong to this portion of the work which treats of ideas. The development of these perceptions could not, moreover, have been classified with any one subdivision of sensations and movements.

By the 31st day[2] the child was able to fixate and to follow, with the necessary accommodations to distance, an object which moved from directly before him slowly to a distance of ten feet. On the same day his eyes followed the slow movements of the carpet sweeper over the floor, as it approached and receded in front and from side to side of the sofa upon which he lay. That the eye had an appreciation of distance derived from its own adjustments independent of those of other sets of muscles seems possible; but it is certain that measures of distance were obtained from data furnished by movements other than those of the eye muscles.

Sensations from the eye and those of movement from another part of the body began to be used together in the recognition of distance about the fifty-seventh day. Shortly before this date it became apparent that the child perceived the breast by sight. Then he learned to reach for the nipple with his head when he chanced to lose his hold upon it. It is uncertain whether the distance thereto was correctly perceived by the eye or not. Inasmuch as accommodations to changing distances were already established, it is posible that he had some percep-

[1] In the third year the child used the phrase 'after a while' intelligently, and invented 'big after a while' to indicate a longer period. All past, immediate or remote, he referred to a yesterday, and a future less fixed than 'after a while' as Sunday. 'Now' meant at once.

[2] Vision, p. 56.

tion of the distance, although the axes of his eyes converged somewhat more than an accurate adjustment would have required. The peculiarity of the reaches with the head was not that they deviated markedly to one side or to the other of an imaginary straight line uniting the position of the child's mouth with that of the object to be grasped; but that they fell short of the mark. In the beginning they did not always become successively longer, and it therefore often happened that no one of the attempts had a fortunate termination. By the fourteenth week success invariably attended the first effort.

The initial attempts at reaching with the hand bore one resemblance to those of reaching with the head; for while the eye plainly perceived what the hand should have touched, there was no accurate adjustment of the arm movements to the distance at which the the object stood. Now there are four ways of explaining this want of adjustment:

1. The eye may not have perceived the distance at which the object stood; or

2. The eye may have perceived the distance and the difficulty have rested altogether upon the arm movements; or

3. Both eye and arm may have been at fault; or

4. The want of adjustment may have been due to a mental gap in the associative connection, as a result of which (gap) eye distance and arm distance failed to combine. By the expression 'arm distance' are meant feelings of movements which correspond to various degrees of extension. The study of arm movements has brought out the fact that arm distance was at this time somewhat established and we have seen above that the eye had received some training in the perception of distance. Therefore the fourth explanation is probably the correct one.

The child was next (thirteenth week) seen to reach for what was within the range of his arm, and not to try for that which was beyond. Here the distance of the arm and that of the eye had combined to form the first concrete measure of distance. A little later (sixteenth week) he did reach for objects beyond the arm range, at the same time leaning towards them or moving his body in their direction. The eye must have

recognized this distance as longer; for the body, as yet untried, had not given an indication of its range. This knowledge was not fully developed till the thirty-ninth week. After the sixteenth week the perception of distances was developed slowly and very gradually, involving on the one hand eye movements and the observation of things seen, on the other the development of the perception of magnitudes gained through hand contacts. It must be remembered that there was a time when the child could not handle what he reached after, when he did not know how to hold what came to him, unless the hand could close over and clasp it. After grasping, reaching and holding had become possible to him his experience was extended from object to object by dint of much practice with each. When he could sit erect and look at what he held, the sensations from eye and hand were at last systematically and not occasionally induced by the same object. In the early days of sitting erect there occurred some illustrations of the process by which the separate perceptions were used to the accomplishment of a common end, and thus made to contribute towards the development of ideas. One of these illustrations is here quoted from the journal:

While the child was sitting in his crib a glass dumb-bell (long diameter four in.), with cut facets was laid in his lap close to his body. This he had not before seen. He held a napkin ring in his right hand. During the performance about to be described his gaze remained fixed upon the dumb-bell in his lap. This he tried to strike with the napkin ring. The blow fell too far out. The attempt was repeated three times with a similar result for each trial. He then with the left hand felt the dumb-bell, after which he struck it successfully once and many times.[1]

Within a few weeks after sitting alone had become habitual the child had acquired some working knowledge of form and size which enabled him to handle objects with more certainty and ease, and here the perception of small distances was developed. By the forty-first week the hand and arm made move-

[1] As I did not watch the child during the time he continued to play thus, I do not know whether any unsuccessful attempts alternated with the successful ones or not.

ments which corresponded to small distances perceived by the eye. In the twenty-ninth week the child began to roll over the floor and so to get himself from one place to another. When he began to creep (forty-sixth week) and later to walk he was already familiar with the lengths to be traversed and had no difficulty in accommodating himself to them. But in the sixty-first week he moved with his parents to a new home, and instead of one room in which to exercise his powers of locomotion, he had now the freedom of two. Much, though not all, of the furniture in these rooms was already familiar to him, but the floor spaces between the individual pieces were considerably larger. His distance measures did not fit the new surroundings at all and for two days the child was like one out of his element. All his efforts at going from place to place ended in disaster. On the third day his accommodation to the new surroundings was well established. Within ten days thereafter a second change was made, and on being taken to a third house the child did not show again the same difficulties of adjustment.

It is probable that the experiences of going towards objects, and of seeing them approach and recede, had an influence all along in the development of the perception of what may be called the horizontal distance. But the effects of such an influence were not obvious to the observer in the way that those of other influences were. The child had a better estimation of horizontal than of vertical distances; but whether this was the result only of the greater number of experiences with them, or also of a second factor such as I have pointed to above, it is impossible to say. He had some perception of height in the forty-seventh week, and this distance was measured by himself, as reaching up, standing, etc. He seemed to have no perception of distance below himself, or depth, before the sixty-eighth week; for though he could go up stairs and inclined surfaces, he would have walked off of platforms, porches and flights of steps with the movements of one who walks upon a plane surface. In the seventieth week he learned to go down stairs, and afterwards recognized at once places in which this method was to be applied, starting upon one occasion to back down from a platform raised more than six feet above the ground. His estimation of

heights beyond those measured by experiences with his own body was always inaccurate. After he had found (eightieth week) that he could sometimes get objects by the aid of a chair, he climbed up continually to try to get what was beyond his own reach, or that of an adult.[1] Thus it would seem that the development of the perception of distance did not depend upon sensations of the adjustments of any one set of muscles; but upon the establishment of concrete measures of distance.

To return to the perceptions of magnitude. After these had been developed according to the method described above, it was noteworthy that he was not impressed by the comparative sizes of things. His ideas of size during the greater part of the second year were absolute rather than comparative. He was repeatedly trying to fit large objects into small places and committed many other blunders of a like nature which showed a failure to grasp the size relations of things. The words 'big' and 'little' did not refer to nice discriminations of magnitude. Things which he called 'big' were strikingly so of their kind, and so of those which he called 'little.' He did not use adjectives to describe intermediate sizes, and if questioned concerning them he would give no reply.

Direction is the relation of an object to the surface of the body. The recognition of direction would seem to have been a matter of association and was evidently established along with the development and use of the sensory apparatus.[2] It was the necessary concommitant of all sensations which lay at the foundation of the perception of distance; but was not so involved with this perception as to be inseparable from it.[3]

Observations revealed the fact that his memory for direction and for distance was not extremely accurate. To quote an observation of the eighty-ninth week in illustration: In playing with a blue stick (the shape of a match stick one inch in length) the child dropped it on the rug, three feet from the border and about midway between the sides of the room. As he was about to pick it up (having seen where it fell) he was called to

[1] At two years, nine months he asked me to get a star to hand to him, saying: "I can't reach it; you can reach it."

[2] Consult Hearing, p. 66; also Vision on the direction of the gaze.

[3] For illustrations consult Hearing, p. 66; also Touch on Localization.

a person who sat nine feet away. In a moment he returned to get the stick and ran beyond it some three feet (till he reached the end of the rug) before stopping to pick it up. Not finding it there he walked back and forth across the rug several times looking for it all the while. At last he gave up the search.

SECTION IV.—SOME NOTES ON THE RECOGNITION AND INTERPRETATION OF PICTURES.

Fifty-third Week.—When the leaves of a magazine were turned for the child pictures of people induced expressions of pleasure; but he took no notice of pictured animals and of very small figures. From this week he often looked at pictures, but his interest continued to be centered upon illustrations representing people.

Seventy-fourth Week.—He designated all pictures by one name (little girl) without regard to contents.

Seventy-seventh Week.—He called the photograph of a baby, baby; any man, papa; any woman, girl.

Eighty-seventh Week.—A barefooted, scantily-clad damsel, standing near a cupid, the child called Mamie, he said nothing about the smaller figure. Among pictures of a number of men he called only one who had a mustache, papa.

Eighty-eighth Week.—The Sistene Madonna interested him frequently. He would look at it and exclaim: "A baby! A mamma! A man! A girl!"

Ninety-first Week.—Of a small picture of a girl (figure 1½ inches in height) sitting with her head buried in her hands, he said: "Girl cry."

Ninety-fourth Week.—He had an attachment for an exaggerated caricature of a cat which he called 'pussy cat.'

He now liked pictures of any description, but especially the small ones among the advertisements in the backs of magazines. He was interested in pointing out and naming conspicuous features of pictures. He got the relations of the various parts quite well, and had some appreciation of the perspective of some pictures.

Ninety-fifth Week.—Seeing for the first time a picture representing a naked child sitting on a bench in the water and holding with one arm a large pen, he said: "A little boy, sit down, boat."

Ninety-seventh Week.—Of a shepherdess and sheep he said: "See dogs, see dogs, mamma!"

Ninety-eighth Week.—Of pictures of men he always recognized Mr. Darwin, M. Charcot, M. Pasteur. A picture of a mountain he called a lady. When told to point to the members of her body he said of each in turn that it was gone, ending by explaining that only her dress was there. If only a part of the body was depicted (the head and trunk, for example) he described the picture as that of a person broken. Of a woman sitting on a chair lashed to the bowsprit of a vessel he said: "Lady, sit down a chair, water, boat." He recognized at once a great variety of pictured boats, which was noteworthy, as twenty-two weeks had elapsed since he had seen ocean or boat, and the pictures were unlike any which he had in the meantime looked at.

Ninth-ninth Week—In this week some experiments were made on the interpretation of simple pictures. I shall not here stop to enumerate the difficulties besetting the experimenter. As I cannot give the pictures, it is only necessary to say that the number and variety of objects and relations correctly apprehended by the child was very large.

One Hundredth Week.—Some cuts of sections of the brain he called 'baby frog' (his name for pictures of embryos). The marbled paper on the inside of a book binding he called flowers.

One Hundred and Third Week.—In this week the meaning and movement of pictures rather than the simple contents began to impress the child, and thereafter he described them, wherever possible, in terms of action. Very little has been said about his recognition of pictures which he had seen before. In the ninety-first week a book of animals was given to the child in which at least fifty individuals were portrayed. The familiar domestic animals he knew at once, and by the afternoon of the next day he could point out nearly all the other animals if they were named for him. The pages of this book were soon scattered and lost.

In the one hundred and second week someone gave the child a little book containing six full-page illustrations and a number of smaller pictures, in all some eight pages of illustrations and text. He looked it through several times, both alone and with another person. This was on March 5th. On March 6th he described to his mother, from memory, each of the full-page illustrations. He spoke of them in the sequence of the book.

One of those memory tests elsewhere mentioned was made with a picture. It was selected from a book with which he was thoroughly familiar. The illustration in question was entitled The Monkey's School, and represented a large monkey wearing a gown, glasses and cap, sitting in the midst of a class of young monkeys also dressed and engaged in various pursuits. All were so disguised that he did not himself recognize them as monkeys. When his grandfather showed him this picture he often repeated a rhyme in which the word monkey occurred. The child himself was most impressed by the school mistress, which he called 'Mamma monkey,' and was accustomed to point to her glasses, cap and book (slate). This picture was abstracted from the book and put away. During six weeks and six days he did not see it; but he saw other pictures of normal monkeys, and sometimes recalled the rhyme when playing with a monkey made of rags. When the picture was restored to him (103d week, the book in the meantime having undergone disintegration) he at once recognized it, called out the rhyme and named the contents according to his former method.

PART IV.—LANGUAGE.

SECTION I.—SOUNDS.

The first sound which the child made was the short, expiratory ă, uttered only in crying. By the twentieth day he evinced a decided interest in sounds. By the thirty-third day he would watch attentively the face of a person speaking to him, and three days later, when being talked or sung to, he began to move his lips and to make some sounds. Ten days after this responsive sounds were habitually made. Then what is familiarly known as 'crowing' began to occur with frequency when the child, lying alone and in comfort, made many and various sounds.

The voice, at first weak, gradually became strong, but prior to the eighteenth week no fixed method of using it was developed. At different times all qualities of tone, from the deep chest tones to the strongly nasal ones, were heard. After the eighteenth week the variation in tones slowly disappeared and the voice gradually settled into a clear falsetto.

By the twelfth week he had begun to use his tongue, which had hitherto moved but little in his mouth. Thereafter there was a rapid increase in the number and variety of sounds made by the child in crying and babbling. It is very difficult for one not practiced in the detection and recollection of sounds to hear and to note accurately all those which a little baby may make in its rapid and continuous babbling.

At the close of the fourth month it was my impression that the child had made well-nigh all the sounds which occur in the language. Yet I had the exact record of but few which had been pronounced as isolated sounds, or as short syllables, and so distinctly as to render their identification easy and certain.

The following is a list of the principal sounds and syllables heard and noted between the twelfth and fortieth weeks:

In crying:

eng	dă	ŭ	mä–mä–ä
mä–ä–ä, explosive	â	ĕ	nĭn nĭn

In babbling:

ĕng	z	gr–r–r	bō wō
ăng	diddle, diddle, ē ē	ing	bow wow
d	ĕ	ŭ–ŭ ŭ	bä
t	th	ŭdn	pop–pä–pä–pä
bä	dth	ŭdŭ	bob–bä
â	ûm gô	good	mom–mä
ô	ă gô	ō	ĕ dä
ŭr–r–r	ä mä	â dä	tä tä
s	hadn	mă	tduck

In the thirty-sixth week he acquired the habit of repeating a sound of his own upon hearing it uttered by another person. In itself this practice may not have been of great moment, but as an intermediate process, leading to the conscious imitation of sounds not his own, it was of importance; for by conscious imitations he got the pronunciations of his words.

In the thirty-eighth week he began to associate a few words with persons and objects. In the fortieth week the associations became established in the case of one word—*papa*. In the forty-second week conscious but unintelligent imitation of words became habitual, and syllables thus acquired occurred afterwards in babbling. These syllables were strung together and uttered with great rapidity, producing a chatter which in its tones and inflections bore a striking resemblance to conversation.

Though so many sounds were uttered with fluency during the months which preceded the acquirement of language, not a word of those which formed the first vocabulary, with the single exception of the word *mamma*, was phonetically an exact reproduction of the word-copy. Each of 238 of the 475 words in the vocabulary passed through one or more transitional phonetic changes before its final form was attained. Table V. illustrates some of these changes; it shows the alterations actually undergone by twenty-six words. The several headings; namely, omission, introduction,, addition and substitution explain

the processes by which these changes were wrought. There is also a column in which is to be found the last recorded pronunciation of the word, and a further column in which, under the caption 'nucleus,' are placed those sounds which belonged to the word-copy and afforded a definite phonetic point around which later changes might take place. Alterations by omission of sounds and of syllables were very common, as is shown in Table VI.

But four instances are recorded of the introduction of extra sounds or syllables into words, and but one case of the addition of a final sound. Alterations by substitution occurred frequently, sometimes alone in the word, sometimes accompanying omissions. When the child had learned but a few words, alterations in pronunciation were often caused by confusion, for example the word *papa*, at first correctly pronounced, became appa when ama (grandma) had been acquired, paba (bä bä= baby) and papē (bē bē=baby) after baby was added. Out of the confusion the word *papa* finally emerged and was thereafter correctly pronounced.

The acquirement of a new sound in a new word frequently preceded its introduction into words wherein it had not before been used; thus, after the child had learned to pronounce w in wash (wass) and woman, w was introduced as a substitute for r. A new sound, once acquired, was likely to crop out repeatedly, in the word in which it had been learned, in other words, and in unintelligent babbling. The occurrence of sounds not in the language was by no means rare. These consisted of gutterals, ch, rs, and the indescribable one which I have tried to express by the h'h in bottle, but which any letters, alone or combined, must fail to convey, and in the German ö (written oe in the tables to avoid confusing with ö).

After having examined Tables IV. and V. the following questions would naturally present themselves and demand a reply before it should be possible to perceive the direction of development:

1. Did the nucleus become larger as the child became older?

2. Were the words seen to pass through fewer changes towards the close of the record?

3. Did omissions and substitutions tend to become habitual—or to state it otherwise, were certain sounds regularly omitted, or replaced by more or less fixed substitutes?

4. How were the habitual alterations broken up and finally replaced by the correct sounds?

If, in order to obtain an answer to the first question, the first ten words of the vocabulary are compared with ten words acquired at the close of the second year, 48.7 % of all the sounds of the first word-copies are found to have been correctly pronounced, and 70.5 % of the sounds contained in the second list of words; 62.9 % of the sounds of twenty words acquired at the close of the second year were correctly pronounced. It may be said that the first ten words might have contained a preponderance of phonetic elements especially difficult to the child. This is to some extent the case, as they contained four sounds which he had not used even at the close of the second year, against one such sound in the second list (these were f, j, nk, ï and ch). The selection of ten additional words eliminated the difference and reduced the average of later words to 62.9 %. The fact remains that the child was able to pronounce a word more correctly by 14.2 % of sounds at the end of a year of practice.

As said above, each of the early words passed through one or more transitional changes. For the first ten words (excepting *mamma*), the average number of changes was 2.8, while five of them had each four transitions. In the ten words taken from the last of the list, there was a maximum of two transitions, one being close to the average.[1]

In looking over Table V. the reader will be struck by the variety of substitutions for each sound. While Dr. Tracy has found the principle of replacement to be that of the substitution of an easier, related sound for the difficult one,[2] we can scarcely, in the face of such diversity of sounds and substitutes, look to his as the *only* principle upon which the apparently lawless replacement of sounds rested. It is doubtless true that

[1] It was impossible to obtain a perfectly correct average for the second list, as at the present time some have yet to undergo a final alteration.

[2] Psychology of Childhood, 2d ed., p. 150.

Dr. Tracy's principle is the underlying one—indeed, the evidence I have at hand lends proof in a general way to his main conclusions. There are, however, other principles, also fundamental, active at different times and in varying degrees. One of these has already been noticed; namely, the confusion of sounds resulting from the acquirement of new words somewhat similar to those already in use. This confusion is more likely to occur in the early stages of learning to speak. Errors in the recognition of sounds were a second and fertile source of imperfect reproduction.

Tables V. and VI. do not afford a full reply to the third question. In glancing at the multiplicity of substitutes recorded in Table V., one would find many cases in which there was apparently no fixed substitute. When pursuing through their changes the courses of the various words, the following facts were found to be true concerning the alterations of sounds; habitual substitutions were evolved in a special word and in the vocabulary as a whole, but habitual omissions were common prior to habitual substitutions. A fixed substitute was not, as one might suppose, always developed with the repeated occurrence of the sound. It appeared sometimes early, sometimes late in the history of a word sound. There can be no doubt, however, that in many cases the addition to the vocabulary of a number of words which contained a certain difficult sound influenced the substitution of a sound. This was the case with the substitution of *oe* for *ir*, six words in which *ir* is found, having been added about the same time. Fixed substitutions were broken up in several ways; by the introduction of a second substitute; by the influence of new phonetic combinations in new words; but chiefly through persistent efforts of the child to correct his mistake, and the consequent approximation of the pronunciation to that of the word-copy.

Yet another question now arises—why was the child unable to reproduce in words, sounds which he had made repeatedly alone and in combination, when babbling before he had learned to speak (trilling l and r; and th, etc.). No doubt the incomplete subjection of the apparatus of speech to the centers of voluntary control had much to do with his imperfect pronunciations.

They may further be traced to faults in perception. What the child did perceive of the spoken word or word-copy were the sounds and syllables emphasized; these he reproduced before he fully distinguished the phonetic elements. In words of more than one syllable he was plainly seen to have been impressed by the rhythm of the syllables as the following lists will show:

E′dith	A′dith	crack′er	ka′ka
grand′ma	a′ma	car′pet sweep′er	gah′luck′n
bot′tle	bot′n	flow′er	bă′loo
Al′len	A′na	thermom′eter	mä′teh
night gown	gi′gown	grand′pa′pa	pa′pa′pa

When the child did distinguish the phonetic elements in a word he did not reproduce it as his own earlier sound (with which he probably failed to identify it), but as a new sound, his articulation of which was controlled on all sides and rendered difficult by his articulation of other sounds in the word.

SECTION II.—WORDS.

Writers who have studied the acquirement of language describe the process by which children learn to speak essentially as follows: The infant perceives an object or action and at the same time hears a certain combination of sounds. Each time the object is brought before him the sounds are repeated, till he comes to associate the sounds with the object, so that when he hears them a memory image of the object is rung up, and upon seeing the object the sounds are called forth. Thus he gets to associate object by object with word by word.

At first he does not attempt the articulation of the words, understanding merely names, simple commands, etc. A little later he essays to reproduce the words, the success of the result being variable. In this manner the vocabulary has its beginning; it undergoes further increase by the same method.[1] My

[1] See article by Professor Sully in Pop. Sci. Mo., for February, 1895.

observations have led me to consider an associative process such as I have briefly described above as the chief underlying process, active throughout the whole period during which language was being acquired. It accounted for the multiplication of speech forms, which, however, was not the only feature of language development. For in addition there was the increasing ability to use more complicated constructions, and the peculiarities of mental activity which were effective in producing the changes in the use of language which were observed at intervals during the second year. These additional features in turn are but different aspects of the process by which the child comes, by a method of successive approximations into the power to use, in common with other persons, a language which he finds prepared for him.

As early as the twelfth week certain sounds were associated with the expression of fixed states of feeling; for the child cried "eng" when hungry, and "Mä-ä-ä" when hurt or in sudden distress. A great variety of sounds, as I have elsewhere stated, occurred when the child was babbling in comfort and contentment; but at such times no one sound was used exclusively. Nevertheless the voice was clearly expressive of pleasure, interest and excitement.

In the twenty-sixth week a peculiar, 'singing' noise was made when the child was contented.

Twenty-ninth Week.—Bob-ba indicated comfort and good feeling. Mom-ma, indicated hunger and other discomforts.

For two weeks, beginning with the thirtieth, he always said 'tä-tä,' after having satisfied his hunger.

Fortieth Week.—'Nin-nin,' indicated hunger.

In the forty-second week *papa* and *mamma* were associated, though not exclusively with his parents.

In this week the child, while playing on the floor at feeding time, suddenly looked up and said, 'mamma, nin nin,' thus indicating that he wished to be fed. He associated 'don't suck' with having his thumb taken out of his mouth so that he removed the thumb upon hearing the command. After this he learned rapidly to understand many words and some phrases. The word *papa* became a proper name for a special individual,

but as late as the fifty-second week *mamma* had been used only under the following circumstances:

1. When his mother had gone.
2. When she reappeared.
3. When he was hungry.

It was two months later when he began to use the word freely in designating his mother, though if the word *mamma* were used in his hearing he immediately looked about for her.

The phrase 'here it is' came into use in the fifty-second week, accompanying the presence of something pleasing, and the act of giving. No similar phrase was acquired prior to the eighteenth month.

The words next added to the vocabulary were those indicating persons and individual things in which the child was especially interested.[1] Dogs had often been pointed out to him and he was familiar with three of quite different appearance, but he used the word *dog* first in speaking to a black mongrel which played around his carriage during an afternoon walk. On the day following he pointed out as a dog a St. Bernard and a small black nondescript. After this the word *dog* fell into complete disuse. It did not reënter the vocabulary till six months had elapsed.

All the above examples, with the exception of one, are instances in which a simple form of association by contiguity controlled the reappearance of sounds and words. Under conditions as similar as possible sounds were repeated as similar as possible to those before uttered. In the exceptional example, that in which he designated as dog two very different representatives of the type, the selection of a name depended upon his familiarity with four other and dissimilar dogs, one of which had only the day before impressed the child exceedingly.

In the fifty-eighth week that period was ushered in during which each word (except some proper names) was given every day a more extended application. Table VII. gives the history of fifteen words which were made of service in many situations. Other writers have discussed the tendency—which seems to be

[1] Upon referring to Table V. it will be seen that all words in the vocabulary at the close of the first year were proper nouns.

common among children—to widen the application of every word,[1] but have not, it seems, found this tendency to be characteristic of a limited period of language development. By some the tendency has been attributed to other causes than the one herein described. I regard it as the outcome of a crude form of inference. In the part of this work devoted to the development of ideas I have endeavored to show what the nature of this inference was.[2] Here I shall not digress from the subject in hand; but shall try to show that the extension of the application of a word did not *necessarily* rest upon (1) an uncircumscribed concept of the thing named, or upon (2) comparison and the perception of analogy.

This period extended from the fifty-eighth to the eighty-fourth week. During that time the child acquired but fifty-three words, yet he was familiar with many objects and could point them out when he heard their names. This shows that his perception of things exceeded considerably his use of words. Though he called all men 'papa' for a short time, he never met a stranger upon the same footing of familiarity as he did his father; and though he called all little girls 'Dorothy,' he never danced with glee at their approach, unless at a distance they bore a striking resemblance to his friend of that name. He always called a cat 'bird,' yet when he heard a voice calling 'cat! cat!' he looked about for the animal exclaiming 'bird! bird!' In these cases it was clearly shown that he did not confuse the individuals comprised by his class name. Whatever the quality of his concept of each of the things named, it was not sufficiently vague to permit of a fusion of individuals. We are, therefore, not justified in assuming such a fusion to be the basis of the class names used by the child. If we look to his concept of the meaning and use of words we shall find the real explanation of this peculiarity; for it will then be seen that he by no means understood the necessity of a separate name for each thing, and that at this period his words were used like so many exclamations by which he announced the presence of what was interesting.

[1] See Tracy, Psychology of Childhood, 2d ed., pp. 78–9, also Baldwin, *op. cit.*, p. 325.

[2] Part III., p. 94.

We may well ask what influences controlled the selection of the word for a wider application. Why, for example, did the child call a cow 'bird,' instead of 'dog,' both of which words were known to him? In the early days of language development each word, whose faulty pronunciation had been laboriously acquired, replaced for a time the old words which for several days were scarcely heard. The child practiced the new word when the object to which it referred was not present, and it entered largely into his babbling; *it had an interest of its own*. The words first spoken were the names of things which had excited a great interest in the child, so that they with their circumstantial setting were in the best position to be remembered. The word whose application was extended was either the most recent addition to the vocabulary, or an old word about which fresh interests centered.

The child saw a cow under circumstances very similar to those in which he had seen birds and dogs; but bird experiences were more recent, bird word fresher, and thus the elements of similarity called up the bird series, rather than the dog series; but the cow, as the central figure, was substituted for the bird, and the child chirped to her, exclaiming 'bird!' Usually the jump from one object to another designated by the same name was not so great as that from bird to cow. The application of the word was extended slowly and by degrees. It depended upon internal association of a very primitive form, and not upon the perception of similarity.

If we regard the tendency to extend the application of words as due to the recall of sounds previously used under conditions of greater or less similarity, we are at once relieved of the necessity of postulating a perception of analogy as a fundamental human faculty. In Part III.[1] we have seen that the perception of analogy was a phenomenon of development depending upon the formation of internal associations, and the consequent mental juxtaposition of like objects, and that it was rudimentary, not to say unformed, during the greater part of the second year. We are therefore not at liberty to invoke the perception of analogy as a means of explanation here.

[1] p. 94.

With the entrance into the eighty-second week the child began to give a name to each object with which he came in contact. If he did not know or recall the name given to it by others he invented a name. A few of the coined names remained in use for several months; others were used once or twice and forgotten. The following lists give:

1. Names invented and retained in use:

lum = a cat.

bizz = his own shadow on the bathroom wall.

bahdiz = a figure on the ceiling of a bedroom.

Alah = a little girl, frequently seen from across the street.

2. Words invented, used only in one conversation and forgotten:

babax = a hinge.

blebs = a very small ledge on the piano.

piece it = to break a piece off, to break into pieces.

3. Often, finding it necessary to have a name, he babbled some jumble of sounds, as it were, gathered together for the occasion and soon forgotten.

bane,

sug,

fē sō back ō are examples of these.

The custom of naming each thing is of course inconsistent with that of classing many things under one name; therefore as the former habit grew the latter diminished, and the classes became smaller by the successive subtraction of object after object. At the close of the second year the child invariably asked the name of a new object, and was familiar, as is shown in Table VIII., with the names of most common things.

By the ninety-fifth week his vocabulary having grown considerably, the child came to a better understanding of the uses of words. The method of acquiring language then underwent a radical change. It became an imitative process. He imitated not only words, but phrases and sentences whose meaning he caught from observation of the actions of his elders. It was shortly after this that he began to be interested in rhymes; at first those containing familiar words as landmarks, then any nursery rhymes or poetry, which he quickly learned to reproduce.

During this preëminently imitative period, what he said expressed no reflections. Unintelligent imitation was rare though it sometimes occurred.[1]

The words that he used stood for visual percepts and memory images; his sentences represented observations on the actions of others, or a running commentary on his own performances.

A little later, ninety-seventh to ninety-ninth weeks, he frequently expressed outlines of actions proposed for himself and other persons, thus: "Say, mamma, Anna git a li' poon Wahn Moh" (Mamma shall say, Anna get a little spoon for Warren Moore), or defined his own intentions before beginning some performance. In the last three weeks of the second year the child began to use language to give the results of his reflections.[2] Language now assumed the function of an instrument with which to marshal and construct concepts.

We have now briefly reviewed the processes by which words were first connected with objects, then used to signify them, and lastly as symbols, substituted for the reality. Let us now turn our attention to the vocabulary itself, to inquire how many words and what classes of words were used by the child, and what the order of acquirement was.

If the reader will refer to table VIII. he will see that all words belonging to the first year were proper nouns—the names of persons (and of his doll)—known and of especial interest to the child. Nor did the acquisition of proper names become less prominent later. The child was always profoundly interested in people, whether real or portrayed in pictures. He quickly learned a name, and remembered it even after the face was forgotten. Many of the proper names in the vocabulary pertained to pictures. After the first proper nouns had been mastered a few common nouns were learned.

From the fifty-second to the eighty-second weeks words were added very slowly to the vocabulary. Though the child

[1] As in the reproduction of rhymes not fully understood; but here the rhythm was doubtless a point of interest.

[2] In the first weeks of the third year he reflected upon many things and was asking for explanations continually: Where were the chickens' hands? Where had the clouds gone? etc.

talked a great deal he made a few words, chiefly nouns, useful within extended limits. After the eighty-second week the acquisition of nouns proceeded at a rapid rate. In the one-hundred-and-fifth week there were 306 nouns in the vocabulary, of which 48 were proper nouns. The others were the names of common objects; for of abstract nouns there was not one.

In the sixty-fourth week the first verb made its appearance, *gone* doing duty for all sorts of disappearance. The verbs in use before the eighty-ninth week differed plainly from action words. They might more fitly be called substantive verbs than verbs proper. Four examples will make my meaning clear. Gone = disappeared, not the act of disappearance, but the phenomenon. See = a word used in calling attention to something perceived through the agency of sight or of touch. Hark = a word used in calling attention to a noise. Come = I wish it to be in this place. *Bye-bye* was the nearest approach to a word designating action; it was a term of vigorous dismissal by which the child signified refusal to obey, or his desire that an extremely distasteful thing should go away.[1] In these substantive verbs, which also partake of the character of interjections and may justly be called interjectional substantive verbs, we have what is really a transitional form.

In the ninetieth week the first action word proper came into use, and was in the succeeding weeks followed by other words unmistakably verbs. These verbs were used in the imperative form—'sit down'! (you sit down) 'brush (my) hair!' etc.—or in describing something performed or experienced by the child himself, as 'fell down' (I fell down). These two forms of verbs (exclamatory and imperative) did full justice to the quality of the child's mental attitude during the period extending from the ninety-first to the ninety-eighth weeks, during which no distinction of tense was made, any form of a verb which had been acquired being used without change. With these two forms he was able to make known his wants and to express his observations.

In the ninety-seventh week he made his first distinctions of

[1] After bye-bye had acquired this secondary meaning the child would never use it to a departing friend whom he wished to remain.

tense; 'I got'=I have got, and 'I get'=I shall get. Thereafter he slowly acquired the ability to use the several forms of the verbs and some of the auxiliaries, *did* being the member of the last mentioned class most frequently heard. Of course he made many blunders in attempting to transform the present tense into the past, usually the common one of adding *ed* to verbs of the old conjugation. In the vocabulary noted in Table VIII. the parts of certain verbs are put down as separate words; this is because they were learned and used as such before the child had caught the practice of using one word under several aspects.

A few interjections also were used. Such as *helloa!* and 'da! da! (indicating something). Representatives of the class of interjections were among the earliest words in the vocabulary.

Adjectives, ranking third in numerical importance, were fifth in the order of acquisition. The adjective first in use was the numeral two (ninety-first week), which was in the beginning correctly employed to designate two things, but later became a plural form signifying any number more than one (still just 2 also). Some of the adjectives of quality were at first used in connection with respective special substantives (awful cough and round O, for example), from which they were separated and endued with a meaning which transformed them into true quality words; others were added to the vocabulary by a process quite the reverse of this, functioning as quality words from the beginning. This was the history of *big* and *new*. An adjective was never used in any but the positive degree.[1] Things were compared and contrasted thus: "This is a dirty napkin." "This is a clean napkin."[2] Color adjectives were the last to be added. Between the ninety-first and ninety-fourth weeks occurred the first numeral (two), the first pronominal (another) and the first undoubtedly intelligent use of an adjective of quality. I could not determine the exact order of acquisition, because sporadic instances of the use of each had previously been

[1] At twenty-eight months he understood the uses of the degrees of comparison.

[2] At twenty-eight months comparison and contrast became a favorite exercise in which the child indulged much. For example he would say: "That's a moth. A very little moth. Not a great big one, just a very little one."

recorded, from which it was impossible to conclude anything as to their meaning to the child.

Adverbs of place occurred early in the phrases, 'here it is' (fifty-second week) and 'where gone?' (seventy-sixth week). The word *here* in the former phrase had no separate adverbial meaning, but the whole phrase, used as a single word was, as I have pointed out, interjectional in character. Later, however, (ninetieth week) *here* was used as a separate word and as a true adverb of place. Thus the adverbs, though far outnumbered by the nouns, verbs, and even by adjectives, antedated all classes of words but interjections, nouns and verbs, albeit the manner of use was difficult to define in its early stages. 'Hard' was by the child himself applied to difficulty in performance.

As early as the eightieth week he was able to distinguish between *mine* and *yours*, and *you* and *I*. It was not till the ninety-sixth week that he began to use them. In the ninety-seventh week he substituted *I* for *Warren* (his name), and later learned to speak of himself as *he*, probably because he heard himself thus spoken of. At first he always substituted *mine* for *your* (*i. e.*, mine coat for your coat), but this error he soon corrected. He did not confuse the genders of the personal pronouns *he* and *she*, and they were usually put in the right case.

As they had been acquired after the imitative period[1] had been initiated, this is not surprising.

Of the remaining parts of speech, classed under 'others' in the table, there is but little to say.

The indefinite article made its appearance in connection with the word *fly* as early as the sixty-fourth week, and was afterwards (from ninety-fifth week on) used before nouns, both plural and singular, and before many verbs, producing a curious effect in sentences, thus: "Little Warren a turn a pages" (Little Warren turns the pages). The definite article had not come into use at the close of the second year.

The copula *and* was used rarely but correctly during the latter part of the second year.

Prepositions were acquired late. The first use of one was recorded in the ninety-fifth week. Though occasions were not

[1] See above p. 125.

wanting upon which a preposition might easily have been used, the relation of object to object was, except in rare instances, expressed by the approximation of substantives, thus—a woman stands a door. At the closing of the record, *in*, *on*, *under*, *by* and *beside* were frequently used, though not always correctly placed in the sentence.[1]

Yes and *no* were rarely heard. In replying to a question the child used a full statement, either of affirmation or of negation.

We have now to determine, before we leave the subject of words, the actual number of words in the vocabulary of the child, and the proportional relations of the parts of speech therein contained. Table VIII. gives the vocabulary in full. Some other words had been used for a time and relinquished; these have not been recorded in what is to be considered a working vocabulary. At the close of the second year the child had in use 475 words. Of these

306	62.3 +	%	were nouns.
92	19.3 +	%	were verbs.
38	8	%	were adjectives.
14	2.9 +	%	were adverbs.
11	2.3 +	%	were pronouns.
14	2.9 +	%	were prepositions, interjections, conjunctions.
475	98.6 +		

In the percentages of nouns, verbs and adjectives in the vocabulary of the child there is a close agreement with the results obtained by Dr. Tracy. I have said that the proportion of verbs to nouns varied at different times. I shall again recur to this variation in proportion when discussing the development of the sentence. In the one-hundred-and-second week I endeavored to note everything said by the child during a single day. At this time he used sentences almost exclusively, no longer expressing himself in single words. 150 different words entered into the construction of the sentences. Of these

[1] This will receive further notice under the sentence.

71 or	46.6 %	were nouns.
40 or	26.6 %	were verbs.
13 or	8.6 %	were adjectives.
8 or	5.3 %	were pronouns.
7 or	4.6 %	adverbs.
11 or	7.3 %	other parts of speech.
150	99.0	

Here in the conversation of the child there existed a larger percentage of verbs in proportion to all the words in use and to the nouns than in the vocabulary as a whole. The following tables show the differences between the order of acquisition and that of the numerical importance of the classes of words in the vocabulary.

Order of acquisition:	Order of numerical importance:
1. Nouns.	Nouns
2. Interjections.	Verbs.
3. Verbs.	Adjectives.
4. Adverbs.	Pronouns.
5. Adjectives.	Adverbs.
6. Articles.	Prepositions.
7. Pronouns.	Interjections.
8. Prepositions.	Conjunctions and articles.
9. Conjunctions.	

SECTION III.—SENTENCES.

The first sentence was uttered in the sixty-sixth week. It contained but two words, 'papa gone,' and was the product of much previous practice on the part of the child, who had made many trials before he was able to pronounce successively the sounds therein contained. The simple assertion, exclamatory in character, was composed of subject and predicate; it was typical of all early sentences. Between the sixty-sixth and seventy-ninth weeks the sentences were either assertions or interrogations. Three verbal forms sufficed for all. For the in-

terrogative form the expression 'rsh' (where is he, she, it?) was used in this way: 'Ama rsh?' (grandma, where is she?) In announcing the presence of something to which he wished to call attention, the child said 'h'r's' (here is) the object named. Thus the child announced something, exclaimed at its disappearance, inquired concerning its whereabouts. These simple sentences were fairly complete—that is to say the omissions, an article or an auxiliary verb, were not essential parts of the sentence. But when the child had acquired a larger vocabulary, he broke away from the bondage of his early copies and launched freely into word combinations. The errors which he then committed were still those of omission, and the most glaring of them was the omission of the verb.

In the eighty-sixth week the imperative sentence made its appearance, and about the same time the affirmative or assertive sentence became more common. The interrogative sentence persisted, altered somewhat in form, but retaining the meaning. The one interrogative form which the child used when inquiring about some absent person or thing was often heard, and to the one hundred and second week remained the only form of question put by the child. After the eighty-sixth week sentence-formation pursued two paths of progress; the one leading towards a more complete expression of the results of his observations of things, the other towards the issuance of many and varied commands. As he was observing what people *had*, rather than what they were *doing*, it was natural that his sentences should have contained a larger proportion of nouns and a smaller proportion of verbs. The use of the emphasis as well as word forms in the expression of certain meanings was very common with the child. He could by its means convey the idea of something having taken place before he could change a verb into its past tense, for example: "Mamma *wash* it, all dirty" (his hand). "*Mamma* wash it, all dirty" (washed). The imperative sentence invariably contained the verb.

Many of his verbs were accompanied by a gesture, attitude, or the act which they signified; for example, when he said, 'bye-bye come' (meaning do not come!) he waved his hand

in dismissal; if he said 'back!' (meaning carry me on your back) he put himself in an attitude of readiness; and when, after a meal, he said 'pull napkin' (take off my napkin), he accompanied the command by a steady pull at the article in question. The accompaniment of a sentence by an action of some sort was the rule till about the ninety-eighth week. In the recitation of past experiences and in those speech forms by which he gave expression to the results of his reflections, gestures were not introduced. During the utterance of the sentences in which the child proposed some course of action for himself he maintained the attitude of one who is ready to act the moment he has finished speaking. Here we come upon an illustration of that intimate relationship of mental to bodily activity which is so apparent in childhood.

Leaving the first simple sentences constructed upon a few unaltered models, and coming to that period in which the sentence became more varied, we find it necessary to frame some definition of a sentence before it is possible to pursue the history of its development. Words were combined in such a variety of ways, so utterly without parallel in the usages of syntax, that I was oftentimes at a loss when trying to get these combinations into a system of classification which should place them in line with adult speech constructions.

I have taken as my definition of a sentence any combination of words whatsoever, beyond the simple naming of an object of sense. This definition allows of the inclusion of those transitional sentence forms which are intermediate between the stages of naming and of describing. The following series of sentences will illustrate my meaning. The child perceives his mother sitting down reading a book; he exclaims:

1. Book.

Later 2. Mamma book.

" 3. Mamma sit down, a book.

" 4. Mamma sit down, read a book.

" 5. Mamma is sitting down, reading a book.

Now No. 2 could not, according to the rules of English grammar, correctly be termed a sentence; yet I have ventured

to call it such, because it represents a complication of thought from which springs a more complex expression than the one used by the child when, by a name, he indicated the presence of an object.

To recur, however, to the construction of the sentence, we may ask what formed the predicate in those sentences from which the verb was omitted. The sentences consisted of nouns so arranged as to express some striking relation between the objects to which they referred. One of the nouns was the subject; by the others was made known the connection in which the subject at the time was seen to be. They therefore constituted the predicate. Examples of such sentences are:

'Man, cow' (a man on a horse). 'Mamma, a man, bottle!' (Mamma, see the man with bottles).

The child often expressed his observations in sentences without verbs, and in those beginning with the word *see*, thus: 'See biscuit mamma hand' (see the biscuit in mamma's hand).

In the ninety-seventh week there was a rapid increase in the number of verbs corresponding to a close watchfulness of the actions of other persons and the growing habit of translating these into such language as he could command. In sentences constructed at this time one and two verbs often occurred. There was also some attempt at producing an agreement of tense and person. Qualifying words made their appearance; some were adjectives qualifying the subject; some were adverbs assisting in the predicate.

The qualifying words first introduced (excepting adverbs of place) were adjectives used to qualify the subject, such as: 'There goes two little boys.' 'Warren's apple is good.' Before the ninety-fifth week the sentences were all very simple, each containing only one statement; but in the ninety-fifth week he began to make some attempts at compound sentences containing two statements or two commands. The second statement of the compound sentence might or might not contain a verb. An example of these first compound sentences is, 'Mamma sit down, rubbers on,' (mamma sit down, put your rubbers on). The example contains one subject who is to perform two separate acts. A sentence sometimes occurred in which there were two

subjects and two predicates. Such a one was composed of two simple statements, sometimes, but rarely, united by the copula *and ;* sentences did not become more complex than this during the second year.

He never used one of the responsives alone in reply to an interrogation.[1] His replies to all questions consisted in a statement, usually a complete repetition of the question cast, by the emphasis upon certain words, in an affirmative or negative form. Towards the close of the second year he began to use yes and no in connection with the full statement, as: 'Yes, I did go for a walk.' 'No, I can't find my pencil.' In the ninety-ninth and one-hundredth weeks the frequent introduction of adjectives, adverbs and prepositions began to give to the sentence the appearance of being more complete.

Of the position of the various words in the sentence there is but little to be said. Such words as the sentence contained were almost invariably in the proper sequence, though the omission of the many small words brought about some unusual and awkward effects due to the proximity of those parts of speech which we are not wont to hear together. There was, however, a peculiarity of construction in which the preposition figured as the chief agent of modification. It has elsewhere been said that before the introduction of the preposition the relation of object to object, which should be expressed by the interposition of a preposition between the names, was indicated by the juxtaposition of the names. When the preposition was introduced, instead of being placed between the two nouns, it was tacked on to the end of the sentence. This happened particularly to the prepositions *in* and *on*. 'See little cup dish on' is an example of the construction. In this example the verb *see* occurs; but a further peculiarity of his use of the preposition was the omission of the verb from the same sentence, as if the preposition stated all that was necessary concerning the nouns. 'Mamma, monkey glasses on,' and 'little hand hole in,' are two illnstrations. *In*, *on* and other prepositions were also used in the customary manner, which gradually superseded the odd construction of which, in the one-hundred-and-fifth week, I found no trace.

[1] The use of the responsives became customary in the twenty-eighth month.

Averages obtained from numbers of sentences noted at different periods indicate some few points well. 163 sentences, each typical, and the whole forming a progressive series which began in the sixty-sixth and ended in one-hundred-and-fifth week contained in all 661 words,[1] an average of 4.05 + words to a sentence. 43.4 % of the 661 words were things talked of, or nouns or pronouns. This allows an average of 1.82 + nouns and pronouns to a sentence. 24.8 + % of the words were verbs, giving an average of 1.06 + verbs to a sentence, considerably more than half the number of nouns. The proportion becomes a striking one when compared with percentages of nouns, pronouns and verbs in the vocabulary as a whole; for we then perceive that the number of verbs at the child's command was less than one-third the number of nouns and pronouns, but when it came to a question of use, the number of verbs employed rose to more than half the number of nouns and pronouns employed. A similarly striking proportion occurs in favor of adverbs, which comprised 9.5 + % of the 661 words, or an average of 0.38 + adverbs to a sentence, as compared with a percentage of 2.9 representing the adverbs in the vocabulary. With adjectives the proportional relations are somewhat different, for they constituted but 7.4 % of the words (8 % of the vocabulary) and averaged 0.28 + to a sentence; 3.7 % of the words were prepositions. The remaining 11.8 % consisted of the indefinite article, a few interjections and an occasional conjunction.

On a certain day in the ninety-sixth week I noted 124 of the primitive sentences, and once again in the one hundred and second week 138 sentences were noted. In Table IX. the results of a study of these sentences are arranged in a form to facilitate comparison. It will be seen that many of the tendencies are here illustrated which have been referred to above in the discussion of the development of the sentence, and of the gradual introduction of classes of words used in forms of construction. It will be seen that the verb came rapidly to the front as a factor in the sentence-formation. There is also a pronounced increase in the average number of words to a sentence, traceable

[1] Not 661 *different* words.

to the introduction of words of all classes, but especially to that free use of the indefinite article which has already been noticed.

From this table we shall learn, also, that the percentage of words of a class contained in the vocabulary is but an indifferent index of the frequency with which representatives of the class are brought into active service. This was made clear in the case of prepositions, whose number, five, is equal in the two vocabularies, while the sentences of the one-hundred-and-second week contained a proportional increase of 44% of prepositional constructions. The indefinite article furnishes a further illustration of this point; for in the sentences of the one-hundred and-second week its employment was found to have made a proportional increase of 45% over the sentences of the ninety-sixth week.

Table IV.—Table Illustrating Changes in the Pronunciation of Words Through.

The Word.	Omission.	Introduction.	Addition.	1st Substitution.	2d Substitution.	3d Substitution.	4th substitution.	Last Pron'nc'tion.	Nucleus of Word.
Edith . . .	1. Dith . .	3. Ădădith .	2. Dithä . .	3. Ădădith .	4. Ädith . .	. . . . .	. . . . .	Ädith . . .	Dith
Jinks . . .	. . . . .	. . . . .	. . . . .	Tsn	Dz	Tdss . . .	Dits . . .	Dits . . .	ĭ
dog	dö	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	dö	dö
bird . . .	bïr	. . . . .	. . . . .	bürd . . .	boed . . .	bād	. . . . .	bād	bd
horse . . .	1. h 2. orse	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	orse	orse
bye	. . . . .	. . . . .	. . . . .	bă	. . . . .	. . . . .	. . . . .	bye	bye
papa . . .	. . . . .	. . . . .	. . . . .	ăppä . . .	päbä . . .	päpē . . .	. . . . .	papa . . .	papa
fly	. . . . .	. . . . .	. . . . .	hlă . . .	lă	hly	ly	lily	ly
grandma .	. . . . .	. . . . .	. . . . .	ämä	gŏmmä . .	gämă . . .	gwămä . .	gwămä . .	gămä
gone . . .	. . . . .	. . . . .	. . . . .	gong	. . . . .	. . . . .	. . . . .	gone . . .	gone
kitty . . .	kĭ	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	kĭ	kĭ
baby . . .	. . . . .	. . . . .	. . . . .	bäbă . . .	bēbē . . .	. . . . .	. . . . .	baby . . .	baby
Allan . .	. . . . .	. . . . .	. . . . .	Ädl	Ană	. . . . .	. . . . .	Ană	Ană
cracker . .	. . . . .	. . . . .	. . . . .	käkä . . .	. . . . .	. . . . .	. . . . .	käkä . . .	k k
down . . .	. . . . .	. . . . .	. . . . .	dŏn	. . . . .	. . . . .	. . . . .	down . . .	down
little . . .	. . . . .	. . . . .	. . . . .	ïtä . . .	lĭl	lă	ittle . . .	ïttle . . .	ïttle
bath . . .	. . . . .	. . . . .	. . . . .	bä	. . . . .	. . . . .	. . . . .	bath . . .	bath
see	. . . . .	. . . . .	. . . . .	zē	. . . . .	. . . . .	. . . . .	see	see
bottle . . .	. . . . .	. . . . .	. . . . .	bŏtn	bŏttē . . .	bŏktĕl . .	bŏh'hle . .	bŏh'hle . .	bŏ l
cry	ky	. . . . .	. . . . .	ky	kwy	. . . . .	. . . . .	kwy	c y
light . . .	. . . . .	. . . . .	. . . . .	lich(gutt'ral)	. . . . .	. . . . .	. . . . .	light . . .	light
garter . .	. . . . .	. . . . .	. . . . .	gärker . . .	. . . . .	. . . . .	. . . . .	gärker . . .	gar'er
car	. . . . .	. . . . .	. . . . .	cäh	. . . . .	. . . . .	. . . . .	cäh	ca
nightgown	. . . . .	. . . . .	. . . . .	gī gown . .	. . . . .	. . . . .	. . . . .	gīgown . .	ī gown
pull . . .	pû	. . . . .	. . . . .	pû	. . . . .	. . . . .	. . . . .	pû	pû
stool . . .	tool . . .	. . . . .	. . . . .	tool	. . . . .	. . . . .	. . . . .	tool	tool

The words are arranged in the order in which they were acquired, except where the serial numbers occur to indicate the order of acquirement.

Table V.—Substitution of Sounds.

A	ā	2 ē ă
	ă	5 ä ī ă
	ä	ă ē ü â
	â	
B		
D		2 y p w 2 m u
E	ē	3 ā ă ä
	ĕ	5 ā 2 ă 2 ü ē ī ow
F		4 h 2 w K., s
G		
H		
I	ī	3 ă 2ä ē
	ĭ	10 ē ĕ ä 3 ă 3 ŭ oe ow
	ï	ü ā oe ō
J		4 d 2 dz ts tds z
K		4 t 2 g p
L		8 ô 2 w d g n
M		n
N		2 ng m g d t
O	ō	2 ô oe
	ŏ	ow ĭ
	ô	û
	ö	ŭ ï oe
P		3 b
Q		k
R		19 w l y ô
S		z h n f
T		ch (gutteral) 2 k g w l
U	ū	ü ô
	ŭ	3 ä ō û ă
	û	ô
	ü	2 ĭ
V		2 b w
W		4 v pf f
X		2 k 2 ks ts
Y		
Z		2 s
th	soft	2 l k f ā
	hard	z
sh		7 s 2 h l
ch		2 t 2 ts d s
ow		ŏ
oi		y
ĭr		5 oe ā ô
ing		oin

Table VI.—Sounds Omitted and Misplaced.

	When Initial.	When Medial.	When Final.	Present but Misplaced.
A	3	2		
D		2	4	
E	1	3		
F	2	1		
G	2		1	
H	9			
I	2			
K	2			
L	1	7	8	1
M	1	1		
N		8	5	2
P	2	1		
R		27	21	
S	17		1	
T		5	5	
U	1			
V		1	1	
Y			1	
th	2	1	1	
sh	1			

Table VII.—Illustrating Extension of Application of Words.

The Word.	Its First Use.	Second.	Third.	Fourth.	Fifth.	Sixth.	Sev'nth.
Papa	his own father.	any man					
Dog	a certain dog.	two other dogs					
Bird	sparrows.	a cow	dogs	cats	any animals not 'flies'		
Horse	a horse	a horse and wagon					
Fly	fly	specks of dirt	bits of dust	all small insects	his toes	crumbs of bread	a toad
Gone	said of an article dropped	any disappearance	go away!				
Little girl . .	a special little girl	a picture of a little girl	any picture				
Down	down	up					
Poor	anything which fell or was thrown down	broken	sorrowful or unfortunate				
Chair	a rocking chair	any chair					
Bye bye . . .	good-bye	go away!	take it away!	do not come!	something has ceased or gone		
Mamie	a young lady in neighboring house who look'd from a window	any lady in any house at the window					
Clock	a clock	a watch					
Cork	a cork	the stopper of the bath tub					
Baby frog . .	a certain picture in his father's book[1]	any picture in any book of his father's	some parallel curves and lines	any picture in any book which he cannot interpret			

[1] The picture in question illustrated an embryo.

TABLE VIII.—WORDS IN VOCABULARY AT CLOSE OF FIRST AND SECOND YEARS.

	PROPER NOUNS.	COMMON NOUNS.	COMMON NOUNS.	COMMON NOUNS.	VERBS.	VERBS.	ADJECTIVES OF QUALITY.	PRONOUNS.	ADVERBS.	OTH'RS.
Edith	Allen	apple	beef tea	cough	am	find	awful	he	asleep	a
Grandma	Ada	apron	bit	cat	are	found	big	him	away	and
Jinks	Allie	aunt	block	comb	bye-bye	fix	beautiful	it	again	along
Mamma	Audubon	bird	bubble	cap	brush	give	clean	I	down	by
Papa	Anna	bread	bell	corner	bring	gave	cool	me	fast	beside
	Blowing Rock	baby	bureau	cover	blow	go	dark	my	hard	for
	Bunker	bath	breakfast	carriage	bark	goes	dear	mine	how	in
	Charcot	bottle	button	corn	belongs	going	dirty	that	here	on
	Catherine	bowwow	blanket	case	bounce	gone	dry	this	now	to
	Dahma	box	chicken	collar box	brought	get	empty	them	out	under
	Dicky	bahdiz	cracker	cushion	boil	got	funny	you	ready	please
	Dorothy	bizz	chair	chin	cry	get up	good		till	good-bye
	Darwin	basin	car	collars	crying	hark	great		there	
	Emerson	bed	cart	ducka	cut	hurt	hot		up	yes
	Frank	book	cow	duck	call	hang	little		where	no
	Faure	butter	coat	dish	can	hide	Merry Xmas			
	Grandma	beans	clock	dirt	can't	help	new			
	Grandmamma	back	cup	door	climb	has	poor			
	Grandpapa	boys	carpet-sweeper	dog	cover	have	pretty			
	Grandpa	biscuit	cake	doctor	comes	kicks	round			
	Gault	basket	cocoa	dinner	coming	knows	red			
	Gorman	body	cork	drink	drink	keep	smooth			
	Glazer	boat	crow	desk	did	left	warm			
	Gerty	bag	can	dough	doing	like	windy			
	Humboldt	belt	cold-cream	dressing-gown	don't	lay	another			
	Josephine	brush	coffee	drawers	drop	lost	all			
	Katy	bundle	cuffs	dust-pan	dance	let	any			
	Kathleen	ball	clothes	dust-brush	excuse	mend	both			
	Luella	blotter		dress	eats	must	more			
	Langtry	bicycle			fell	make				

TABLE VIII.—WORDS IN VOCABULARY AT CLOSE OF FIRST AND SECOND YEARS.—*Concluded.*

	PROPER NOUNS.	COMMON NOUNS.	COMMON NOUNS.	COMMON NOUNS.	VERBS.	VERBS.	ADJECTIVES OF QUALITY.	PRO. NOUNS.	ADVERBS.	OTH'RS.
		polywog	soap	tree						
		pie	shaddock	tooth brush						
		petticoat	sheet	tin pail						
		pencil	shirt	train						
		pages	smoke	towel						
		post office	shoes	thermometer						
		people	stick	trousers						
		pocket	stocking	thumb						
		parasol	slippers	tack						
		plant	sugar	toe						
		pease	scissors	top						
		package	saque	uncle						
		potatoes	string	umbrella						
		purse	shoe-buttoner	veil						
		quilt	somebody	water						
		rose	skates	wrapper						
		rocking-chair	snake	wind						
		ring	sneeze	watch						
		rain	sleeve	woman						
		rubbers	stomach	wagon						
		room	sofa	window						
		rag bag	sail	wings						
		ribbon	shutters	walls						
		red ball	strap							
		rabbit	sunlight							
		sterilizer	sun							
		stool	teeth							
		shadow	tongue							
		spoon	table							

TABLE VIII.—WORDS IN VOCABULARY AT CLOSE OF FIRST AND SECOND YEARS.—*Continued.*

	PROPER NOUNS.	COMMON NOUNS.	COMMON NOUNS.	COMMON NOUNS.	VERBS.	VERBS.	ADJECTIVES OF QUALITY.	PRONOUNS.	ADVERBS.	OTH'RS.
	Maggie	elephant	berries	mouth	muss	wash	some			
	Mamie	eye	heart	milk	open		this			
	Marjory	ear	hiccup	music	pull		that			
	Maidie	eraser	hole	money	push		what			
	Napoleon	fly	ice	mug	put on		one			
	Percy	foot	Indian	mittens	put away		two			
	Pasteur	feet	juice	medicine	play		three			
	Porter	fur	jacket	machine	play peep		five			
	Rubenstein	flower	kitty	nightgown	ride		six			
	Stanley	finger	kiss	nose	run					
	Shaw	fish	kitchen	napkin	see					
	Suche	frog	kangaroo	nail	sit					
	University	fork	knife	neck	shut					
	Warren	floor	kettle	necktie	singing					
	Wylie	flour	knee	needle	sweep					
	Wayne	gloves	light	noise	say					
	Yorke	girl	lum	orange	spill					
		garter	ladder	piano	sew					
		goose	lady	picture	show					
		gate	leaves	pin	stop					
		glasses	lap	paper	set					
		grapes	letter	pan	stay					
		hat	leg	plants	stick					
		hand	leaf	plate	stand					
		house	lid	pimple	take					
		head	leggins	piece	turn					
		horse	man	pussy	throw					
		handker-chief	men	pot	tied					
		holly-	monkey	pig	torn					
			meat	pillow	untied					

TABLE IX.

NINETY-SIXTH WEEK.	ONE-HUNDRED-AND-SECOND WEEK.
124 sentences containing 384 words.	138 sentences containing 570 words.
Vocabulary = 118 words.	Vocabulary = 150 words.

NUMBER AND PERCENTAGE OF WORDS OF A CLASS CONTAINED IN:

	THE SENTENCES.		THE VOCABULARY.		THE SENTENCES.		THE VOCABULARY.	
	No.	Percentage.	Number.	Percentage.	No.	Percentage.	Number.	Percentage.
Nouns and Pronouns.	200	52.0 + %	72	61.5 + %	267	46.8 + %	78	52. %
Verbs.	82	21.3 + %	22	18.6 + %	131	22.9 + %	40	26.6 + %
Adjectives	29	7.5 + %	11	9.3 + %	37	6.4 + %	13	8.6 + %
Adverbs	26	6.7 + %	5	4.2 + %	46	8.0 + %	11	7.3 + %
Prepositions	13	3.3 + %	5	4.2 + %	21	3.6 + %	5	3.3 + %
Others	34	8.8 + %	3 (art. 1, interj. 2)	2.5 + %	68	11.9 + %	3(art. 1, interj. 2)	2.0 + %

Average number of words to a sentence	=	3.02 +	
" " nouns and pronouns[1]	=	1.6 +	
" " verbs	=	0.6 +	
" " Adjectives	=	0.23 +	
" " Adverbs	=	0.2 +	
" " Prepositions	=	0.10 +	
Percentage of sentences containing no verb	=	33.8 + %	

Average number of words to a sentence	=	4.1 +
" " nouns and pronouns*	=	1.9 +
" " verbs	=	0.9 +
" " adjectives	=	0.27 +
" " adverbs	=	0.3 +
" " prepositions	=	0.15 +
Percentage of sentences containing no verb	=	7.2 + %

[1] Read " to a sentence " after all but first and last lines.

Table X.—Table Illustrating the Development of the Sentence.

	The Sentence.	Its Meaning.
66th week.	Păpē gong	Papa is gone.
	Ämä rsh?	Grandma, where is she?
70th week.	Papa, h'r's itta gur.	Papa, here is a little girl.
79th week.	Ama er gong?	Where is grandma?
	Bēbē ky	The baby is crying.
82d week.	Poo' Deekēy down	Poor Deeky has fallen down.
86th week.	Poo' bowwow ĕ down	Poor bowwow fell down.
89th week.	Hĭ down!	(You) sit down.
91st week.	See two by	See two boys.
93d week.	Heh come cä	Here comes a car.
	Mamma, see book lap	Mamma, see this book, and take me on your lap to look at the pictures.
95th week.	Lil by sit down, a boat	A little boy is sitting down, and a boat.
	Papa, come on, see vind, vind b'ow	Papa come on, see the wind; the wind blows.
96th week.	Wahwon's dess cawnah	Warren's dress is in the corner.
	Caw Anna	(You) call Anna!
	Mamma dis vay	Mamma, put the dish away.
97th week.	Ee goes two men	There go two men.
98th week.	Fin' it, a lil pitser	Find a little picture.
100th week.	Play mamma	Play with mamma.
101st week.	Mamma, Wahn git down, sō gahmpa zussahs	Mamma, Warren will get down to show grandpa the scissors.
103d week.	See Percy papa doing	See what Percy papa is doing.
	Wahn a goyn a Bowling Wock	Warren is going to Blowing Rock.
	Percy papa come home, Wahn give im a butn	When Percy papa comes home Warren will give him a button.

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